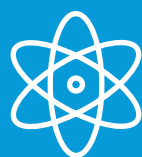


CCAS Research SHOWCASE



2023 ABSTRACT SUBMISSIONS

THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON, DC

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MESSAGE FROM THE DEAN



This year's Research Showcase, which is being hosted for the first time by the Columbian College of Arts and Sciences, is a point of immense pride. I am so impressed by the more than 130 research abstracts submitted by undergraduate and graduate students from across the college. Disciplines ranging from anthropology, art therapy and American studies to philosophy, physics and public policy are represented. And the topics explored include everything from sustainable chemical design, food security and COVID-19's long-term impact to nuclear energy, PTSD, workplace and gender discrimination, autism and critical race theory.

This work is a testament to the broad reach, depth and interdisciplinarity of what we do in our classrooms, labs and studio spaces. CCAS is home to "the engaged liberal arts," in which students integrate their knowledge in the sciences, social sciences, the arts and the humanities, and then immerse themselves in experiential learning and critical thinking to develop new pathways of knowledge and discovery.

It is my hope that the CCAS Research Showcase will be an impactful and memorable milestone on a continuing journey to create positive change. These are students ready to join the next generation of scientists, scholars and artists who are equipped to meet the challenges ahead with fresh and innovative ideas. Climate change, AI technology, data privacy, space exploration and global disease are just some of the issues that call upon the best and brightest minds to move us forward. Our students—bolstered by an education grounded in analyzing problems, thinking creatively and communicating effectively—are that future.

Mentoring this next generation of leaders, scholars and entrepreneurs is a great honor and privilege, but also requires diligence and dedication. We are grateful to the research mentors who have invested their time, expertise and care to enable our students to present this wide variety of interesting and impactful work.

Congratulations to each of the participants in this Research Showcase. We applaud your efforts and look forward to you continuing to engage and inspire all of us in meaningful ways.

Sincerely,

A handwritten signature in black ink that reads "Paul J. Wahlbeck". The signature is written in a cursive, flowing style.

Paul J. Wahlbeck
Dean, Columbian College of Arts & Sciences
The George Washington University

SCHEDULE OF EVENTS

9:30 - 10:00 a.m.

GRADUATE STUDENT POSTER PRESENTER
SET UP

10:00 a.m. - Noon

GRADUATE STUDENT POSTER
PRESENTATIONS

Noon - 12:30 p.m.

GRADUATE STUDENT POSTER REMOVAL

12:30 - 1:00 p.m.

UNDERGRADUATE STUDENT POSTER
PRESENTER SET UP

1:00 - 3:00 p.m.

UNDERGRADUATE STUDENT POSTER
PRESENTATIONS

3:00 - 3:30 p.m.

UNDERGRADUATE STUDENT POSTER
REMOVAL

RESEARCH SHOWCASE

AMERICAN STUDIES

“I Lost but I Gained:” D.C. Abortion Clinics, Self-Help Feminism, and Making Space

In June of 2022, the Supreme Court overturned its prior ruling in *Roe v. Wade* (1973), reigniting debates over what constitutes equitable access to reproductive care. Yet, one need only turn back to the early years of the women’s liberation movement to see that Washington, D.C., was once a vanguard city in the fight for accessible abortion. Due to the Supreme Court case *U.S. v. Vuitch* (1971), abortion was broadly legal in D.C. for two years prior to the landmark *Roe v. Wade* (1973) decision. During this interregnum, D.C.’s abortion care landscape demonstrated not only what legal abortion care could look like in America, but also how specifically feminist abortion care could operate in spite of infighting among its radical and liberal advocates. Clinics adopted self-help practices and reinvented historically oppressive medical settings to better suit the needs and wants of female patients. Yet, the majority of scholars do not recognize D.C. as a birthplace of the radical self-help mainstays of bodily education, woman-woman support networks, and demedicalized care. This thesis seeks to underscore how D.C. abortion clinics effectively reworked health care systems for women by honing in on the specific practices of the PRETERM clinic, one of several independent operations in the 1970s. Upon digging into clinics’ medical documents, educational pamphlets, and ideological manifestos, it becomes evident that between *Vuitch* and *Roe*, D.C. abortion clinics pioneered a demedicalized, woman-centered approach to reproductive health, successfully fusing radical and liberal practices amidst a fractured activist landscape to forge revolutionary sanctuaries of care.

Primary Presenter

Lauren Guzowski

Status

Undergraduate

Author

Lauren Guzowski

Research Mentor/ Department Chair

Suleiman Osman

RESEARCH SHOWCASE

AMERICAN STUDIES

The Influence of Fossil Fuel Money in Academia

In recent years, fossil fuel combustion has been responsible for approximately 73 percent of the U.S.'s greenhouse gas (GHG) emissions and 89 percent of the world's emissions. While taxpayers have been forced to pick up the tab for the climate crisis, fossil fuel companies have continued to prosper. In 2021, leading fossil fuel companies made \$205 billion in profits, of which their executives pocketed \$394 million.

It's no mistake that fossil fuel companies have continued to make major financial gains through the climate crisis; fossil fuel industry executives, knowingly, have long misled the public about their impact on it and used their profits to manipulate climate research. Many of the nation's most prominent universities, including Harvard, MIT, and George Washington, are awash with fossil fuel funding.

I analyzed the contributions of key fossil fuel companies and allied interests to leading climate research universities. ExxonMobil Corporation, BP America Inc., Chevron Corporation, Shell Oil Company, ConocoPhillips, and Koch Industries donated at least \$677,373,368 between 2010 and 2020 to 27 universities. The top recipients of fossil fuel funding were the University of California, Berkeley; the University of Illinois at Urbana-Champaign; and George Mason University.

University research partnerships with fossil fuel companies play a key role in bolstering these companies' reputations. When universities allow fossil fuel companies to buy and advertise connections to university research on key climate and energy issues, they provide these companies with much-needed scientific and cultural legitimacy.

To hold fossil fuel companies accountable, eliminate conflicts of interest within university funding streams, and end fossil fuel exploitation of the credibility of academic institutions, climate activists, allies, academics, and universities must work to establish funding transparency, institute just conflict-of-interest and gift acceptance policies, and ban fossil fuel money in climate research.

Primary Presenter

Isabella Kumar

Status

Undergraduate

Author

Isabella Kumar

Research Mentor/ Department Chair

Thomas A. Guglielmo

RESEARCH SHOWCASE

AMERICAN STUDIES

A Crisis of Faith: Gentrification and Its Impacts on Historically Black Churches in Washington, D.C.

Since their founding, Historically Black churches have been centers of religious life, community development, and activism for the Black community. The Black church and its leaders in D.C. specifically have played a critical role in the liberation struggles of Black Washingtonians, including being marshaling grounds for the March on Washington, existing as safe havens for residents during and after the 1968 riots, and being leading activists in the fight for increased affordable housing in the city.

Washington, D.C. is also one of the most rapidly and intensely gentrifying cities in the United States. While gentrification has been studied in detail, churches and other faith-based institutions have largely been neglected from this discussion. Black churches, however, are crucial to a fuller understanding of how African American residents are affected by and respond to gentrification. More than mere religious institutions, Black churches have a much broader role in the social fabric of Black communities and a rich history as mediating institutions between members and a government/society that did not welcome them.

My research investigates how gentrification has been uniquely affecting Black churches in Washington, D.C. in the last fifteen years, why this is a critical issue, and how D.C.'s Black churches have responded, primarily using oral histories and newspaper articles from the last fifteen years. As newcomers have moved into the city, there have been increased conflicts over parking lots and bike lanes that have alienated longtime church members and community leaders. Furthermore, a lack of affordable housing places an increased burden on churches, forcing them to shut their doors and displacing them to the suburbs of Maryland or Virginia. This displacement has been shown to lead to fewer resources for the city's most vulnerable populations, and it is critical that Black churches remain in the city.

My research discusses responses that these churches have taken, including the formation of interfaith networks that advocate for increased Black homeownership and for more resources towards faith-based institutions.

Primary Presenter

Claire Lanthier

Status

Undergraduate

Author

Claire Lanthier

Research Mentor/ Department Chair

Suleiman Osman

RESEARCH SHOWCASE

AMERICAN STUDIES

The Maury Hall Takeover: Contextualizing SDS at GWU in the 1960s

On April 23rd, 1969, student protestors of the Students for a Democratic Society (SDS) at George Washington University seized control of the Maury Hall academic building for about five hours. They protested for the “end to the Institute for Sino-Soviet Studies, the severance of University ties with the Naval Logistics Research Laboratory and with the Human Resources Research Offices, an end to ROTC and military recruiting on the GW campus, and open admission into the George Washington University for all Black students.” The Maury Hall takeover was one of many anti-Vietnam war protests on college campuses in the 1960s and an example of a familiar strategy for SDS protestors. Although many have examined how a national anti-war movement used Washington D.C. as a stage for protests on the mall and at the Pentagon, academics have not studied SDS at George Washington University and how their local strategic communications, methods of protest, and ideology related to this larger, national movement. Drawing on original archival research, this paper analyzes how GW Students for Democratic Society (SDS) protestors mobilized in the Maury Hall takeover against the Vietnam War in the 1960s, and how these protests fit into the larger SDS and anti-war movement nationally and within Washington D.C.

Primary Presenter

Alexa Miller

Status

Undergraduate

Author

Alexa Miller

Research Mentor/ Department Chair

Suleiman Osman

RESEARCH SHOWCASE

ANTHROPOLOGY

Misinformation Narratives in the COVID-19 Pandemic: The Case of Reddit

Social media platforms provide a variety of affordances for representing historical events. Reddit - with its long-form capacity - permits the greater elaboration of temporal and functional variations through response time and the degree of anonymity allowed. Analyzing Reddit posts based on a periodization timeline, we aim to conduct a comparative validation of the timeline to a pre-existing set of misinformation beliefs, put forth by the Kaiser Family Foundation. Using this critical framework to understand the spread of disinformation on social media platforms like Reddit, we look to explore the creation of contested knowledge and narratives online during the COVID-19 pandemic.

Primary Presenter

Daria Dzen

Status

Undergraduate

Authors

Anannya Sharma

Daria Dzen

Research Mentor/ Department Chair

Joel Kuipers

RESEARCH SHOWCASE

ANTHROPOLOGY

Mapping an Ecosystem of COVID-19 Memorial & Advocacy Groups

For three years, advocacy groups for issues surrounding COVID-19—including temporary and physical memorials, days of remembrance, recognition of “long COVID,” and unaddressed grief—have grown in prominence. They utilize social media to grieve together, call on their elected officials for action, and communicate their goals to the public. In contrast to government statements that it is time to “move on,” these organizations continue to provide protected spaces for those affected by COVID-19. In such an atmosphere, resources and attention become increasingly scarce, as mourners vie for a voice in what is remembered and what is forgotten (Ricoeur 2004; A. Assman 2012; Beiner 2018). The management, leadership, forms, and values of such important work require thorough investigation. What can we learn by mapping out COVID memorialization groups and their connections? What do these connections then tell us about overall memorialization patterns? In this presentation, I sketch the COVID-19 memorialization ecosystem and pose these and other questions to invite dialogue about the methods of mapping social movements, especially in a contentious political environment.

Primary Presenter

Maura Kelly-Yuoh

Status

Undergraduate

Author

Maura Kelly-Yuoh

Research Mentor/ Department Chair

Sarah Wagner

RESEARCH SHOWCASE

ANTHROPOLOGY

Skeletons are Awesome: an educational comparative osteology resource

Comparative osteology – the identification of animals based on the anatomy of their bones – is a cornerstone of biological anthropology and archaeology. Teaching and learning comparative osteology can be facilitated by digital repositories of 3D scans of bones, which are accessible to students in laboratories across the globe without access to physical comparative osteology collections. While large repositories of scanned bones exist, these function primarily as discovery tools geared towards researchers. The “Skeletons are Awesome” tool is being built to serve as a resource for K-12 and university students as they learn comparative osteology. The comparative functionality of the website allows for a side-by-side appreciation of the variation between two skeletal elements of different taxa. Comparison between the same bone of different taxa forms the base of comparative osteology, and a side-by-side view is often essential to learn how the size and shape of skeletal features differs. These differences offer clues into the functional morphology of different animals. The repository currently contains a combined 713 scans from the osteology collections of GW’s Paleoecology and Paleoanthropology Research (PAPER) Laboratory and the Smithsonian National Museum of Natural History, and it is growing with each new research project students in the lab complete. Currently, the scans encompass 20 mammalian genera including Carnivora, Primates, and Artiodactyla.

Primary Presenter

Alyssa McGrath

Status

Graduate

Authors

Alyssa McGrath

Emily LaBrasciano

Olivia Poole

Sophia Muir

Alison Sherwood

Sloan Fridrich

W. Andrew Barr

Research Mentor/ Department Chair

W. Andrew Barr

RESEARCH SHOWCASE

ANTHROPOLOGY

Behavior, Genetics, and Facial Patterning of Dogs

Coloration patterns of domesticated dogs are diverse, and this is especially true for dog faces, which can include special features like eyebrows, white spots, and beards. These facial patterns and facial features likely play a role in social communication with humans and other dogs. Studies of domestication and breeding of dogs, horses, foxes, and mice have shown that specific pigmentation patterns seem to co-vary with certain behavioral styles. For example, white spots or a blaze on the face are thought to be a potential by-product of breeding for tameness. Research on genetics and physiology have in part explained this connection between pigmentation patterns and some behavioral tendencies. For example, pigment-producing melanocyte cells are derived from the neural crest, just like neurons, and early embryological neurological development can simultaneously impact pigmentation and neurobiology (e.g. gene MITF is associated with white spotting). This project asks: Is there an association between facial color patterning and behavioral tendencies in dogs as might be expected if they are influenced by some of the same genes? We collected data from human volunteers who provided videotapes/photos and completed questionnaires about their dogs. We examined matched-data on color (facial) phenotypes and a proxy measure of gregariousness in > 100 dogs of various breed groups. Specifically, we asked: Do scores of expressivity/gregariousness show a marked difference between solid-color vs patterned faces? And for those with patterned faces, is there a difference based on the presence/absence of major white markings? Our preliminary findings indicate there is not a significant association between pigment types (solid: $M = 7.73$, $SD = 1.94$; non solid: $M=8.83$, $SD: 2.55$) and measures of gregariousness/expressiveness ($t(100)=1.62$, $p= 0.637$). This was also the case for white marking ($M =7.60$, $SD= 1.76$) versus no major white markings ($M =8.13$, $SD=1.80$) ($t(102)=1.34$, $p= 0.185$). However, the presence of eyebrows ($M = 7.83$, $SD=1.70$) versus no eyebrows ($M = 7.65$, $SD = 2.38$) was associated with a significantly higher expressivity score ($t(101) = 4.74$, $p < 0.001$). Next steps include a multivariate analysis including other factors like the dogs's breed, sex, and age. But our preliminary results suggest that dogs with white markers are not generally scored as more expressive or more social, but facial features in general - like eyebrows - can impact the perception of dog expressiveness.

Primary Presenter

Daria Ordynat

Co-Presenters

Courtney Sexton

Colleen Buckley

Status

Undergraduate

Authors

Courtney Sexton

Colleen Buckley

Brenda J. Bradley

Research Mentor/ Department Chair

Brenda J. Bradley

RESEARCH SHOWCASE

ANTHROPOLOGY

A Magnetic Investigation of Paleofire on Three Early Pleistocene Sites

The oldest evidence for hominin-controlled combustion comes from the early Pleistocene site, FxJj20 AB (~1.5 Ma) of the Okote Member, located in the Koobi Fora Formation of the Turkana Basin, in northern Kenya. Evidence of fire at this site has been detected through a multi-proxy approach. Magnetic susceptibility can detect magnetic anomalies that may be reflective of previous instances of burning. Magnetic susceptibility allows insight into the spatial variation of magnetic properties of rocks and insight into the spatial characterization of magnetic susceptibility anomalies. Here we compared three Early Pleistocene archaeological sites from the Koobi Fora Formation, FxJj20 AB (1.5 Ma), FxJj 1 (1.87 Ma), and FxJj50 (1.5 Ma) across time and space to investigate the presence of ancient combustion in association with archaeological horizons. Both FxJj1 and FxJj50 are excavation surfaces that have been exposed over the last several decades. We collected magnetic susceptibility measures across a 30 cm grid at the same stratigraphic level of the previous excavation surface. Geospatial techniques were used to identify spatial patterning across the excavation surface. Evidence of ancient combustion features are present in the localities where sediments were recently exposed. However, in those localities where excavation surfaces have been exposed for decades, the magnetic signatures are modified by post-depositional processes. This investigation illustrates the potential of magnetic susceptibility to investigate ancient combustion features by identifying magnetic anomalies in ancient sediments. This technique will continue to be implemented at FxJj20 AB and applied to newly excavated archeological sites to identify magnetic anomalies indicative of past burning events.

Primary Presenter

Victoria Rainis

Status

Graduate

Authors

Victoria Rainis

Dan Palcu

David R. Braun

Emmanuel Ndiema

Sarah Hlubik

Research Mentor/ Department Chair

Sarah Hlubik

RESEARCH SHOWCASE

ART THERAPY

Creating a Safe Space: Classroom Based Art Therapy Through the Lens of the ETC

Objective: Traditionally, in a school setting, art therapists work with students individually or in small groups, but do not provide art education. However, art therapy in the classroom setting works with an entire classroom to meet both educational and therapeutic goals. Furthermore, it ensures equitable access to mental health services, established safety within a trauma-informed environment, and strong development of both the therapeutic and peer relationships. By engaging with autonomy and creativity, students are encouraged to use the process of artmaking as a form of expression and catharsis while following the program of studies established by the school-district.

Methods: This study consist of two qualitative case studies within the same self-contained high school classroom for students with emotional, behavioral, and social disabilities. Students are seen for a 90-minute block period every other day, with an average class size of five students. Observations took place over the first half of the school year. The dynamics of the classroom are constantly changing due to long- and short-term absences, as well as students' individual levels of functioning. Artmaking was viewed through the lens of the Expressive Therapies Continuum to maintain consistency and promote a trauma-informed space, establishing further relationship building.

Findings: The cases demonstrated the importance of safety and peer support. Safety is established through consistent routine and expectations, rapport building, and the therapeutic relationship. Within the classroom, the peer relationship plays an equally important role. Art therapy became a safe space for containment of emotions and was used as an opportunity to test boundaries and limits knowing that the classroom environment was a secure base.

Implications: Art therapy has a transformative power in the classroom environment. In therapeutic educational settings, art therapy can contribute to both safety and peer support to facilitate students' overall development. The work done inside of the classroom has effects outside of the classroom, in that it builds resiliency and further fosters positive peer relationships. While this branch of art therapy is underrepresented within the field of research, advocacy efforts are currently being made at a school-district level.

Primary Presenter

Nichole Baldino

Status

Graduate

Author

Nichole Baldino

Research Mentor/ Department Chair

Jordan Potash

RESEARCH SHOWCASE ART THERAPY

Attachment Minded Art Therapy and Emotion Regulation in the School Setting: Case Study

Objective: Art therapy intervention within the school setting provides opportunities to support emotion regulation needs with attachment-minded approaches. The artmaking process serves as a tool for emotion expression and can contribute to building secure foundations from which students can learn and practice emotion regulation skills that decrease maladaptive and disruptive behaviors displayed in school.

Methods: A qualitative case study explored the relationship between emotion regulation and attachment-minded art therapy and its implementation within the school setting. Thirteen individual art therapy sessions were held weekly at a public school, aiming to address goals of emotion identification, expression, and regulation. Therapist used a person-centered, open studio approach and directive-based interventions as needed, considering the client's presenting needs when determining session direction.

Findings: The client demonstrated an increase in emotion regulation skills within the art therapy space and sessions were used to express emotions and explore how they use artwork to connect with others. Within the classroom, emotion regulation skills appeared to decrease, and the client was eventually moved to an alternative classroom towards the end of the school year.

Implications: This case study demonstrated the benefits of an attachment-minded approach to providing art therapy within a school setting. This approach supported the client in their emotion exploration by providing security within the therapeutic relationship. Providing services within the school increases opportunity for collaboration with individuals that regularly serve the client. Further research warrants further exploration of expanding the security of the therapeutic relationship to other relationships within the client's life.

Primary Presenter

Chelsea Baxter

Status

Graduate

Author

Chelsea Baxter

Research Mentor/ Department Chair

Jordan Potash

RESEARCH SHOWCASE ART THERAPY

The Loss of Autonomy and Self in the Face of Trauma: A Case Study into Alzheimer's Dementia

Objective: With more than six million Americans diagnosed with Alzheimer's disease, this major neurocognitive disorder is the common cause of dementia. As a progressive disease, Alzheimer's Dementia deteriorates an individual's ability for memory, recall, and cognitive function. Due to the degeneration of these functions, increased help is needed for those with Alzheimer's Dementia with their daily activities. There is the possibility that this loss of autonomy caused by Alzheimer's can retraumatize individuals whose trauma circles around the loss of autonomy and self. This study investigated how art therapy supports a trauma informed approach to self-expression and autonomy building for those diagnosed with Alzheimer's disease.

Methods: This study utilized a qualitative single retrospective case study design. This case study follows the weekly individual and group art therapy sessions of a woman diagnosed with Alzheimer's Dementia spanning from October of 2021 to May of 2022. The art therapy as usual sessions were person-centered and positive psychology informed to best fit the needs and goals established by the client.

Findings: In both individual and group art therapy sessions, the client was able to express and reflect on her emotions. A frequent topic was how her current experiences of Alzheimer's disease reminded her of past personal trauma. The client's participation in art therapy allowed her the opportunity for autonomy and emotional regulation through self-expression and artistic exploration.

Implications: While not all of those diagnosed with Alzheimer's disease will have experienced trauma around loss of self and autonomy, those that have might be retraumatized by the experience of Alzheimer's disease. The implications for this study support the need for trauma-informed art therapy for those diagnosed with Alzheimer's disease. This is to ensure that the best quality of life and care are being provided to such individuals as they are experiencing a loss of self and autonomy.

Primary Presenter

Brianna Issenberg

Status

Graduate

Author

Brianna Issenberg

Research Mentor/ Department Chair

Jordan Potash

RESEARCH SHOWCASE

ART THERAPY

Investigating the role of art therapy in promoting autonomy in pediatric oncology patients. A multiple case study approach.

Objective: Every year, over 10,000 children are diagnosed with a form of pediatric cancer. As part of their treatment, children can face long, or frequent hospital stays and invasive medical procedures which can create additional stress and psychosocial implications, including loss of autonomy and their sense of control. In adult oncology settings, art therapy has been established as a valuable service in alleviating various psychosocial symptoms, while promoting patients' self-confidence and instilling a sense of control in their treatment. The current study aims to explore art therapy's role in promoting autonomy in a pediatric oncology setting.

Methods: This study employed a qualitative multiple case study approach. A person-centered approach to art therapy guided the sessions with two pediatric oncology patients as part of their art-therapy-as-usual during in-patient treatment. Observation notes and patients' self-disclosed experiences will be used as measures in this study.

Findings: This study is currently ongoing. Preliminary findings indicate that art therapy during in-patient treatment for pediatric cancer can instill self-confidence and promote patients' autonomy. Incorporating art therapy methods such as patient-led material choice and directives have been established as contributing factors.

Implications: This research will add to existing research on the value of art therapy services as part of oncology treatment, particularly pediatric settings. Building on existing research on art therapy's role in instilling autonomy, this research will add a pediatric lens while also adding to the literature advocating for the increased presence of art therapy in pediatric oncology settings.

Primary Presenter

Laura Mahon

Status

Graduate

Author

Laura Mahon

Research Mentor/ Department Chair

Jordan Potash

RESEARCH SHOWCASE

ART THERAPY

Bookmaking in an art therapy group with active-duty service members with TBI and PTSD: Case study

Objective: Although art therapy has been used with the U.S. Military for over seventy years, there is no published work on the use of bookmaking in art therapy with service members. Books provide portable containment, which allows for safety when working on goals of stress reduction, identity development, emotional regulation, and trauma-processing. This case study explores different ways bookmaking can be used in art therapy with active-duty service members and understanding their experiences.

Methods: The art therapy for stress reduction group was for service members with TBI and PTSD, who created books focused on what hope is to them. Three patients from different branches of the military and of different ranks attended and created books.

Findings: The benefits from this case parallel several observations noted in the professional literature, which include: storytelling, positive interactions, and community building. The service members supported one another and formed connections through their shared experiences. Additionally, creating books on hope resulted in each of the service members identifying their children as their hope, making their books for their children, and promoting positive relationships.

Implications: This case study indicates that utilizing bookmaking in art therapy groups could be beneficial for service members with TBI and PTSD while in treatment.

Primary Presenter

Caitlyn Razzano

Status

Graduate

Author

Caitlyn Razzano

Research Mentor/ Department Chair

Jordan Potash

RESEARCH SHOWCASE

BIOCHEMISTRY AND MOLECULAR MEDICINE

PredictMod: An Application for Predicting Patient Response Status to Interventions for Prediabetes

Prevalence of prediabetes is rising as 34% of Americans are prediabetic, with the vast majority unaware of their condition. Consistent elevation of blood glucose in conditions like prediabetes and type 2 diabetes (T2D) often lead to more severe diseases such as heart disease and stroke. Therefore, providing preventative care to patients diagnosed with these conditions is of the utmost importance. Several studies indicate an association with gut dysbiosis and the progression of prediabetes to T2D. Additionally, lower beta diversity by reduction in specific microbial taxa (e.g., butyrate-producing bacteria) is well documented with the onset of prediabetes. This provides a potential approach to identifying signals within the gut microbiome of prediabetic individuals that can aid in predicting patient outcomes prior to intervention. Machine learning (ML) can be used to detect these microbial signals and identify key patterns for predicting prognosis, particularly by learning from patients undergoing dietary modifications or implementing regular exercise. We demonstrate an approach that uses whole genome sequencing gut microbiome data publicly available from a clinical trial to predict patient outcomes from baseline signatures. Furthermore, a similar ML-based model was generated using synthetic patient health records to predict responder status as this data is more readily available. The models trained on metagenomic and synthetic patient data were able to perform at 90% and 83% accuracy, respectively. These models were incorporated into a web application, PredictMod, which was designed to assist clinicians with treatment decision making. We propose a proof of concept that metagenomic data, alongside electronic health records, are able to help clinicians in their decision-making with interventions designed to prevent prediabetes progression to T2D.

Primary Presenter

Urnisha Bhuiyan

Status

Graduate

Authors

Stephanie Singleton

Lori Krammer

Julia Zhu

Hadley King

Miguel Mazumder

Thomas Voigt

Atin BasuChoudhary

John David

Max Bradley

Raja Mazumder

Research Mentor/ Department Chair

Raja Mazumder

RESEARCH SHOWCASE

BIOCHEMISTRY AND MOLECULAR MEDICINE

Deletion of Negative Elongation Factor B in epithelial stem cells accelerates mouse skin wound healing

Following injury, keratinocytes must rapidly coordinate changes in gene expression while contributing to stages of inflammation and proliferation that are required for healing. One mechanism that keratinocytes utilize to regulate gene expression is through promotor proximal pausing of RNA Pol II through the Negative Elongation Factor (NELF) complex. To date, little is known about how the NELF complex contributes to changes in gene expression that occur during wound healing. To investigate this, we used a conditional knockout mouse model of the *Nelfb* gene in keratinocytes to disrupt the NELF complex. We found through immunofluorescence tissue analysis greater re-epithelialization and angiogenesis during proliferation when *Nelfb* is knocked out in keratinocytes. Subsequent flow cytometry analysis of the myeloid leukocytes revealed that populations of macrophages were significantly increased at very early timepoints post-wounding, suggesting that altered inflammation promotes accelerated tissue repair when *Nelfb* is knocked out in keratinocytes. Thus, the NELF complex has a pivotal role in regulating pro-inflammatory genes in keratinocytes and may be a suitable target in treating patients that suffer from delayed wound healing.

Primary Presenter

Vu Nguyen

Status

Graduate

Authors

Vu Nguyen, Camille

Brechot, Khatereh

Khorsandi, Brett Shook

Research Mentor/ Department Chair

Brett Shook

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

***Sideritis syriaca*, *Punica granatum* Peel, and *Aronia melanocarpa* Leaf Extracts Act as Potent Natural Inhibitors of Amylin Aggregation and Cellular Toxicity in Pancreatic β -Cells**

Type II Diabetes Mellitus (T2DM) is a metabolic disease that is becoming concerning more common worldwide. The loss of pancreatic β -cells over time and accumulation of insoluble protein plaques or amyloid are hallmarks of the disease. This β -cell loss and pancreatic amyloidosis are thought to be caused by excessive accumulation, aggregation and toxicity of pancreatic hormone, human islet amyloid polypeptide (hIAPP) or amylin. Impeding or reducing amylin aggregation and/or its toxicity can be key to preventing pancreatic β -cell loss and potentially T2DM.

Here, we characterized the potential anti-aggregative and anti-toxic properties of the three natural plant extracts from *Sideritis syriaca*, *Punica granatum* peel, and *Aronia melanocarpa* leaves. *Sideritis syriaca* extract was chosen as it contains epigallocatechin-gallate (EGCG), a compound known to disrupt amylin organization into insoluble fibrils. *Punica granatum* peel was chosen as it contains lipoic and ascorbic acids, both known amylin aggregation inhibitors. *Aronia melanocarpa* leaf extract was chosen because it contains chrysin and polyphenols, which are known for their anti-oxidative properties. It remains uncertain if these small natural molecules show any anti-aggregative and anti-toxic amyloid potentials within their natural environment-extracts of native plants, which we examined in this project.

The three plant extracts at 0.005 mg/mL, 0.05 mg/mL, and 0.5 mg/mL were tested for their anti-aggregative and antitoxic properties in the presence of 30 μ M hIAPP over 24 hours. The protein aggregation Thioflavin-T assay revealed that when any of the three extracts at 0.5 mg/mL concentration were mixed with amylin, there was a significant and potent (<2-3-fold) decrease in the rate and extent of amylin aggregation. All three extracts displayed a strong dose-dependent aggregation inhibitory effect, suggesting its anti-toxic potential. Indeed, the MTT viability assay demonstrated that when rat pancreatic insulinoma (INS 832-13) cells were pre-treated with increasing concentrations of any of the three plant extracts there was a significant protection against amylin toxicity ($p < 0.05$, $n = 6$, ANOVA). This strong, dose-dependent, and protective properties of plant extracts against amylin toxicity can be attributed to their anti-aggregative and anti-oxidative properties, which require further verification. The results from this study demonstrate effectiveness of natural products to halt amylin aggregation and toxicity *in vitro*, which could be exploited as novel therapeutics and strategy against islet amyloidosis in patients with T2DM and potentially other neurodegenerative diseases. In the future, we aim to conduct CD spectroscopy studies to better understand the biochemical mechanism by which these extracts prevent amylin misfolding

Primary Presenter

Rishisree Achanta

Status

Undergraduate

Authors

Rishisree Achanta

Aleksandar Jeremic

Research Mentor/ Department Chair

Aleksandar Jeremic

Damien O'Halloran

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Early life adversity alters social dominance behavior in mice

Parent-offspring interactions during the early postnatal period are critical for nervous system development. For a neonate, the relationship with a parent is the most important interaction and source of sensory input that they have during development. Disruptions of these interactions due to exposure to adverse experiences early in development can lead to long-lasting changes in brain physiology and behavior, including changes in sociability, a hallmark of several psychiatric disorders. In this study, we aimed to examine the effects of ELS in the form of fragmented maternal care on social behaviors. In this approach we utilized the limited bedding and nesting paradigm (LBN) in C57bl/6 mice. Four days following birth (PND 4) the dam and pups were transferred to cages with a wire-mesh surface and reduced bedding provided then returned to standard home cage conditions at PND 11. The weights of the animals were tracked and recorded at different stages during development. Our results show that ELS leads to decreased weight in male and female pups relative to controls (PND 21: average mass ELS males $7.12 \pm 0.46\text{g}$ ELS females $7.01 \pm 0.11\text{g}$ vs control males $9.46 \pm 0.13\text{g}$ control females $7.80 \pm 0.87\text{g}$; PND 35: average mass ELS males $17.59 \pm 0.51\text{g}$ ELS females $14.34 \pm 0.64\text{g}$ vs control males $20.49 \pm 0.86\text{g}$ control females $16.28 \pm 0.87\text{g}$; and PND 80: average mass ELS males $23.33 \pm 0.15\text{g}$ ELS females $17.8 \pm 0.17\text{g}$ vs control males $30.5 \pm 0.76\text{g}$ control females $22.38 \pm 0.50\text{g}$). To investigate the effects of ELS exposure on adolescent social play, we looked at the time control and ELS adolescent mice (P35-39) spent interacting with an age- and sex- matched conspecific in their home cage. Finally, we investigated social dominance behavior in adulthood (P80). To examine dominance behavior, we used the dominance test tube approach, in which mice were separated by sex and competed to exit a narrow, open-ended tube. Analyzing intra-cage dominance hierarchies showed that male mice established a more stable dominance hierarchy than females. Additionally, inter-cage dominance test results show that in both sexes, ELS mice are more likely to exhibit subordinate behavior to control mice. The results of this study suggest that mice exposed to early life adversity based on LBN protocol exhibit changes in social behavior, suggesting that early life environment programs the circuits required for later life social cognition.

Primary Presenter

Reem Bahr

Status

Undergraduate

Authors

Reem Bahr

Alexandre Kisner

Abigail M. Polter

Research Mentor/ Department Chair

Abigail M. Polter

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Intron retention plays an important regulatory role in gene expression and progression of Type-2 Diabetes Mellitus

Intron retention (IR), one major type of AS, occurs when introns are retained in mature mRNA. IR is more prominent in the neural and immune systems. IR is deployed as an important gene regulatory mechanism in a variety of processes, including cell differentiation, cell activation, cancer, aging, etc. IR can be detected using RNA-seq. T2DM is characterized by persistently increased blood glucose levels or hyperglycemia. Three hallmarks of T2DM are the insufficient ability of pancreatic β -cells to secrete insulin, decreased insulin sensitivity of peripheral tissues, and the deposition of amylin-derived aggregates, or amyloid. Whether IR is involved in the progression of T2DM is not known. We explored the IR changes in two separate systems: short-term stress (healthy islets under metabolic stress) and long-term stress (T2DM) using publicly published RNA-seq data. First, we observed that IR increased in both systems, with IR increased genes enriched in the metabolic process and proteasome process. Second, we found that NMD (Nonsense-mediated decay) and splicing factor are associated with increased IR in the short-term and long-term systems respectively. Third, IR was found to be associated with loss of beta-cell identity and proteasome malfunction in T2DM. Above all, our results provide evidence that IR is involved in T2D progress through regulating gene expression.

Primary Presenter

Qing Chen

Status

Graduate

Authors

Qing Chen

Aleksandar Jeremic

Weiqun Peng

Research Mentor/ Department Chair

Aleksandar Jeremic

Weiqun Peng

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

The benefits of *Nuphar advena* come at the cost of competition in restored tidal marsh

Healthy wetlands, especially in urban settings, provide important ecosystem services such as storm protection, water purification, and recreation. The restoration of Kingman Marsh, a freshwater tidal wetland on Washington DC's Anacostia River, has faced challenges in restoring pre-disturbance levels of plant biodiversity, largely due to herbivory from a resident Canada goose (*Branta canadensis*) population. Previous studies have examined community makeup and how geese herbivory impacts the vegetative cover of each species in the marsh. There has been strong growth of the highly unpalatable yellow pond lily (*Nuphar advena*) at Kingman Marsh, meanwhile, restoration managers have struggled to maintain palatable wild rice (*Zizania aquatica*), a native annual species that supports multiple ecosystem services including sediment stabilization, nutrient retention, and food for biota. In summer 2022, a transplant experiment was completed to determine whether *N. advena* could provide herbivory defense to *Z. aquatica* against resident geese. Data was collected on caged and uncaged transplants inside and outside patches of *N. advena*, and inside patches where *N. advena* was cleared to allow greater light penetration. *N. advena* was found to significantly reduce grazing, but there was a cost to *Z. aquatica* to growing in low light conditions— transplants within *N. advena* had greater mortality and significantly reduced health. A transect survey of herbivory on wild *Z. aquatica* also demonstrated that increased density of *N. advena* reduced geese grazing of wild rice. Future research should seek to understand an optimal level of *N. advena* cover which could provide the associational defenses benefit with less shading, and investigate if there is below-ground competition between these two important freshwater tidal marsh species.

Primary Presenter

Thomas Huebler

Status

Undergraduate

Authors

Thomas Huebler

Keryn Gedan

Aliya Khan

Research Mentor/ Department Chair

Keryn Gedan

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Virulence Characterization of a Self-Fertilizing Nematode and Its Symbiotic Bacteria in a Model Insect Host

Despite their potential to act as a tripartite model to study host-vector-pathogen relationship, the interaction between the fruit fly *Drosophila melanogaster*, the entomopathogenic nematode *Steinernema hermaphroditum*, and its symbiotic bacteria *Xenorhabdus griffinae* is acutely understudied. This project aims to profoundly characterize this relationship, starting with exploring the effect of *S. hermaphroditum* nematodes and *X. griffinae* bacteria infections have on the survival of *D. melanogaster* larvae in comparison to two well characterized nematode species, *S. carpocapsae* and *Heterorhabditis bacteriophora*, as well as three bacteria species *X. nematophila*, *P. luminescens*, and *E. coli*. Infection experiments involved exposure of *Drosophila* larvae to each of the three different nematode species and injection with the four bacteria species. After infection, larvae survival was recorded at 12-hour intervals. Our results indicate that *S. hermaphroditum* and *H. bacteriophora* nematodes are significantly less pathogenic toward *Drosophila* larvae compared to *S. carpocapse* ($p < 0.0001$). These results indicate that *S. hermaphroditum* nematodes employ a distinct strategy to infect insect hosts and the *Drosophila* immune response varies according to the type of nematode it encounters. Further dose-response infection experiments with *S. hermaphroditum* revealed that even 10 nematode parasites are sufficient to kill *Drosophila* larvae. In bacterial injection experiments, there was no significant difference in virulence of *X. griffinae* and *X. nematophila*, while both species are more pathogenic than *P. luminescens* and *E. coli* ($p < 0.0001$). It was also identified that, an injection of approximately thirty *X. griffinae* cells are enough to cause the most lethal effect on infected fruit fly larvae populations. Overall, these findings set the stage for understanding the molecular and functional bases of nematode and bacteria parasitism, as well as host anti-nematode and anti-bacterial immunity, which will lead to possible ways to interpret how might the human immune system interacts with potent parasitic nematodes and their symbiotic parasites.

Primary Presenter

Tien Huynh

Status

Undergraduate

Authors

Tien Huynh

John Hawdon

Ioannis Eleftherianos

Research Mentor/ Department Chair

Ioannis Eleftherianos

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Vibro, Psuedoalteromonas, and Shewanella are isolated from spotting disease lesions in purple sea urchins

Spotting disease is a lethal disease of sea urchins that infects a wide variety of species in all oceans. Development of an infected lesion requires an injury, which occurs when the body wall is pierced by the spines of another sea urchin. In a single aquarium in our laboratory, four sea urchins contracted spotting disease and were evaluated for infecting microbes. Samples were collected with sterile swabs from the surface of the lesions, the periphery of lesions, and from non-lesioned surfaces of infected sea urchin and healthy sea urchins. Samples were also collected from dissected tissues of the lesioned body walls and from the non-lesioned body walls and coelomic fluid from diseased and healthy sea urchins. The samples were streaked on marine agar plates and single colonies were isolated. Each bacterial sample was Gram stained and the genomic (g)DNA was isolated using the cetyl trimethylammonium bromide DNA method. The presence of bacterial gDNA was verified by PCR amplification of the 16S rRNA gene. gDNA was sent for Sanger sequencing of the V1-V9 region in the 16S rRNA gene (Genewiz). The sequences were assigned taxons based on BLAST matches in NCBI, SILVA, and DECIPHER. Results showed that the bacterial species belong to the genera Pseudoalteromonas, Shewanella, and Vibrio. Vibrio was the most prevalent on the periphery of all lesions, whereas the lesion surface showed a prevalence of Pseudoalteromonas, Shewanella, and Vibrio. Vibrio was more prevalent than Shewanella in the lesioned body wall. Although Vibrio was present in all healthy body wall samples and the non-lesion samples of infected sea urchins, Shewanella was more prevalent than Vibrio in the body wall samples from healthy sea urchins. Vibrio and Shewanella were also identified from the coelomic fluid samples from both diseased and healthy sea urchins. Overall, the microbes on the lesion surface were Pseudoalteromonas, Shewanella, and Vibrio, but in the non-lesioned body wall of the healthy sea urchin body, only Vibrio and Shewanella were present. In both the surface and body wall of non-lesion samples from diseased sea urchins, only Vibrio was present. Future investigations will test whether the isolated microbes are pathogenic when inoculated onto surface wounds on sea urchins and develop into spotting disease lesions. Results may apply to understanding spotting disease in maricultured sea urchins because few reports identify the pathogens. The microbes that we identify, which may be pathogens underlying spotting disease may indicate why the disease is lethal

Primary Presenter

Lorenzo Lopes

Status

Undergraduate

Authors

Lorenzo Lopes

Chloe haw

L. Courtney Smith

Research Mentor/ Department Chair

L. Courtney Smith

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Binding and Aggregation of Recombinant Sea Urchin Transformer Proteins with Bacteria

The California purple sea urchin, *Strongylocentrotus purpuratus*, possess a unique class of immune response proteins known as SpTransformer (SpTrf) proteins. Seven recombinant (r)SpTrf proteins isolated from insect cell expression cultures were incubated with four marine bacterial species. The goal of the incubation was to determine whether these rSpTrf proteins were capable of binding to bacteria. The four bacteria used *Bacillus cereus* (Gram-positive), *Vibrio diazotrophicus* (Gram-negative), *Vibrio sp. 1* (Gram-negative), and *Vibrio sp. 2* (Gram-negative). Both *Vibrio sp.* were isolated from sea urchins with spotting disease and identified by 16S ribosomal RNA gene sequences. Western blot analysis was used to determine whether the rSpTrf proteins bound to the bacteria. Initial results indicated that *B. cereus* and *Vibrio sp. 1* were bound by the same five rSpTrf proteins, and that all rSpTrf proteins bound to *V. diazotrophicus* and *Vibrio sp. 2*. Furthermore, a subset of the rSpTrf proteins showed aggregation that correlated with bacterial aggregation during incubation in artificial coelomic fluid (aCF). To determine the cause of rSpTrf aggregation in aCF, the proteins were incubated in each of the ions in aCF; calcium, potassium, magnesium, sodium, chloride, bicarbonate, and sulfate. Calcium ions aggregated the rSpTrf proteins and consequently may have contributed to the aggregation of the bacteria. Native SpTrf proteins (nSpTrf), isolated via nickel affinity, also aggregated in aCF to confirm that rSpTrf protein aggregation in calcium was not a consequence of expression in insect cells. Preliminary binding assays between *B. cereus* and the rSpTrf proteins in the absence of calcium ions showed that only one of the original five proteins bound, however, five of the original seven proteins bound to *V. diazotrophicus*. Binding results for the other two *Vibrio* species are currently being collected. rSpTrf binding in the absence of protein aggregation suggests that these immune proteins may function to identify and opsonize possible pathogens of *S. purpuratus* and target them for an appropriate cellular immune response.

Primary Presenter

Athanasios Naum

Status

Undergraduate

Authors

Athanasios Naum

Ryley Crow

Research Mentor/ Department Chair

L. Courtney Smith

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Only skin deep: Defining amphibian skin immune responses against the deadly chytrid fungus

The chytrid fungus, *Batrachochytrium dendrobatidis* (Bd) infects amphibian skin resulting in the disease chytridiomycosis, which is a leading cause of worldwide amphibian declines and extinctions. The nature of these Bd-skin infections renders it imperative to gain greater insights into how amphibians mount skin immune responses. Unfortunately, amphibian immune systems differ in several respects from the much more thoroughly characterized mammalian immune systems, thus presenting a challenge to defining the successes and pitfall of amphibian skin immune responses to Bd. Most studies of amphibian skin immunity to date have focused on antimicrobial peptide defenses and have neglected the roles that skin-resident immune cells, such as macrophages or soluble mediator cytokines produced by these cells, which dictate immune responses. Unfortunately, there is no consensus regarding what aspects of the skin-resident amphibian responses render these animals susceptible or resistant to Bd. To bridge this knowledge gap, we performed comprehensive time-series studies, exploring the kinetics of amphibian (*Xenopus laevis*) cytokine responses to Bd skin infections. Our results indicate that successful anti-Bd immunity corresponds to effective hallmark inflammatory responses to this pathogen. Moreover and contradicting prominent beliefs in the field, our work indicates the increasing skin immune tolerance does enhance anti-Bd resistance but instead renders animals more susceptible to this pathogen. We believe that this work represents an important step forward in our understanding of amphibian antifungal defenses.

Primary Presenter

Netra Ranganathan

Status

Undergraduate

Authors

Netra Ranganathan

Christina Garvey

Kelsey Hauser

Riad Hossainey

Leon Grayfer

Research Mentor/ Department Chair

Leon Grayfer

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Novel facilitation by a guild of ecosystem engineers: leaf-tying caterpillars facilitate leaf-mining caterpillars on hickory

Diverse arthropod communities serve as prey for a variety of animals, including birds, small mammals, and other taxa, and play an essential role in supporting ecosystem services. With anthropogenic climate change, global insect communities are declining, threatening many organisms that rely on diverse insect communities and insect-mediated ecosystem services. Consequently, it is essential to understand factors that promote diverse arthropod communities, including habitat heterogeneity, which can be generated by ecosystem engineers. One such ecosystem engineer, leaf-tying caterpillars (Lepidoptera) create shelters that offer refuge from predators and physical elements by binding overlapping leaves together with silk. While leaf-tying caterpillars are ubiquitous across several plant species, their ability to modulate local patterns of insect herbivore diversity and the effects of plant architecture on leaf tier communities remain unclear. This study documents how plant architecture and leaf tie availability affect plant-level arthropod diversity across three tree species without a well-described leaf tier community. In a fully factorial experiment conducted at two field sites in DC and Maryland, 120 understory trees were randomly assigned to control, leaf tie removal, or leaf tie supplementation treatments. Every three weeks from June to September, we censused the chewing herbivore community without removal to measure herbivore richness and abundance. This study demonstrates that plant architecture strongly influences leaf tier communities and overall herbivore diversity, although the magnitude of this effect varies across host plants and over time. Most notably, in hickory, leaf-mining caterpillars, who feed internally within the plant tissue, experienced a ten-fold increase in density within leaf ties compared to non-tied leaflets, representing a novel facilitation between two caterpillar guilds. To conserve declining insect populations and insect-mediated ecosystem services, identifying predictors of species diversity, including the roles of ecosystem engineers and plant architecture, is vital.

Primary Presenter

Sarah Shamash

Status

Undergraduate

Authors

Sarah Shamash

John Lill

Research Mentor/ Department Chair

John Lill

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Not toeing the line: Redefining the biological roles of amphibian lateral line

Aquatic organisms like fish and frogs possess specialized skin structures called lateral lines. These organs possess highly adapted mechanoreceptors that serve to perceive water vibrations and movement, allowing animals to orient themselves in water currents and integrate information about their environments. While very limited, some recent literature suggests that in addition to mechanoreception, fish lateral lines also play roles in fish immune defenses. Whether or not amphibian lateral lines likewise participate in antimicrobial responses is currently unknown. Notably, amphibians are facing alarming global declines and extinctions largely due to emerging infectious agents that infiltrate these animals' skin tissues. Unfortunately, amphibian skin immune defenses remain poorly characterized, thus warranting greater resolution of what mechanisms exist within these animals' skin tissues that may serve as means of detection and combating etiological agents of their declines. Accordingly, we examined the possible immune roles of the lateral line of the *Xenopus laevis* clawed frog. Towards this goal, we performed comprehensive immune gene expression and histological studies of *X. laevis* lateral lines. We believe that our work will grant a new perspective into how amphibian skins serve as immune barriers to important emerging pathogens.

Primary Presenter

Radha Varadan

Status

Undergraduate

Authors

Radha Varadan

Christina Garvey

Kelsey Hauser

Riad Hossainey

Leon Grayfer

Research Mentor/ Department Chair

Leon Grayfer

RESEARCH SHOWCASE

BIOLOGICAL SCIENCES

Characterization of Macrophage Populations in Mouse Models of Prostatic Diseases

Immunotherapy has been shown to have low efficacy in treating prostate cancer, due to low T cell infiltration in the prostate tumor microenvironment (TME). In prostate cancer, tumor-associated macrophages (TAMs) constitute a significant percentage of noncancerous cells in the TME and are predicted to play a role in tumor progression. As these specialized phagocytes can exhibit pro- or anti-inflammatory responses, establishing a deeper understanding of the characteristics that different TAMs possess could lead to the development of more effective targeted therapies, and help to elucidate the role of macrophages in tumor progression and metastasis.

We hypothesized that the recruitment of macrophages plays an important role in promotion of prostate growth in mouse models of prostate cancer as well as a phenylephrine-induced mouse model of benign prostatic hyperplasia (BPH). Through immunohistochemical staining for macrophage markers CD206 and CD68 on wildtype control, BPH, and prostate tumor tissues, the presence of macrophages in these tissues was verified. Androgen signaling plays a key role in prostate cancer pathogenesis. To assess whether androgen receptor (AR) expression in these macrophage populations is associated with cancer cell proliferation and migration, tissue sections were stained for immunofluorescent AR expression. Furthermore, to determine whether these immune cells arise from tissue-resident macrophages that originate from fetal yolk sac or fetal liver precursors, cells were labeled with a fluorescent protein using a tamoxifen-inducible Cre model and lineage-traced.

Results indicate that the number of macrophages was significantly higher in prostate cancer tissues than in BPH and wildtype tissues. Additionally, the location of these macrophage populations differed between the three groups, with tumor samples exhibiting the highest degree of epithelial infiltration. These observations suggest a positive correlation between macrophage number and disease severity. Together, these findings highlight the involvement of macrophages in diseases of the prostate, making them a feasible target for immune cell based therapies.

Primary Presenter

Peri Wivell

Status

Undergraduate

Authors

Peri Wivell

Maho Shibata

Research Mentor/ Department Chair

Maho Shibata

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Skin fibroblast subsets contribute to injury-induced inflammation through spatiotemporal changes in pro- and anti-inflammatory gene expression.

Skin wound healing requires an initial phase of myeloid cell recruitment and inflammation, which must subsequently resolve for the tissue to transition to a reparative state. Pro-inflammatory signals are known to arise from epithelial and immune cells; however, the contribution of mesenchymal cells to injury-induced inflammation remains under-studied in acute wound healing. Since fibroblasts contribute to acute inflammation in other tissues and chronic inflammatory skin diseases, we hypothesized that dermal fibroblasts support acute inflammation after skin injury. To identify fibroblast-derived factors which could mediate this effect, we characterized fibroblast gene expression with RT-qPCR and RNA sequencing in a murine skin wound model at multiple time points throughout acute inflammation. Dermal fibroblasts acquired a pro-inflammatory gene expression profile at time points representing early and peak inflammation, upregulating cytokines and chemokines known to contribute to an inflammatory environment and immune cell recruitment. These factors influence the quantity of the immune cells in the tissue, as fibroblast-specific deletion of the chemokine *Ccl2* significantly reduced the number of monocytes and macrophages present in wounds at the peak of inflammation. As inflammation resolves, the fibroblast gene expression profile changed to reflect the tissue's shift to an anti-inflammatory, pro-remodeling environment. At this late inflammation time point, fibroblasts expressed secreted factors associated with extracellular matrix formation and the dampening of immune responses. To complement our gene expression analysis, we performed RNA fluorescence *in situ* hybridization to spatially map fibroblast inflammatory gene expression at the wound periphery throughout tissue inflammation. We identified distinct patterns of spatial bias for numerous cytokines, chemokines, and tissue remodeling enzymes. Since fibroblast subsets can be defined based on their location in the skin, these biases suggest that distinct fibroblast populations contribute to the inflammatory environment, cell recruitment, and tissue organization after injury. Overall, these results convey that dynamic changes in gene expression allow multiple populations of skin-resident fibroblasts to actively participate in the induction and resolution of inflammation during wound healing.

Primary Presenter

Veronica Balick

Status

Graduate

Authors

MaryEllen Haas

Shatha Salameh

Brett Shook

Research Mentor/ Department Chair

Brett Shook

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

c-Met Regulates Head and Neck Squamous Cell Carcinoma Epithelial-Mesenchymal Transition Through Transcription Factor BACH1

Metastasis is estimated to be responsible for 90% of cancer deaths, and fewer than 10% of patients with metastatic head and neck squamous cell carcinoma (HNSCC) survive beyond 5 years. HNSCC is responsible for upwards of 270,000 global deaths annually, with up to 30% more cases projected annually by 2030. The proto-oncogene MET encodes for the tyrosine kinase receptor c-MET, which is overexpressed in over 80% of HPV-negative HNSCC cases and particularly enriched in metastatic lymph nodes. c-MET is activated by its ligand, hepatocellular growth factor (HGF), and is known to promote cancer cell migration, proliferation, and metastasis through a variety of downstream effectors. Thus far, unfortunately, inhibition of c-MET has shown low efficacy as a single-agent therapy in clinical trials, which indicates a need for further understanding of the mechanisms underlying c-MET-mediated metastasis in HNSCC. We show here that human HNSCC cells upregulate expression of the transcription factor BACH1 through c-MET activation upon HGF treatment. In accordance with previous reports, elevated levels of BACH1 protein increased expression of epithelial-mesenchymal transition (EMT) markers and cell migration. By pharmacological inhibition of c-MET by FDA-approved Capmatinib with the genetic knockdown of BACH1 we show reduced expression of EMT markers beyond either of these treatments alone. Similarly, BACH1-depleted HNSCC cells treated with Capmatinib reduced migration compared to either treatment alone in scratch-wound migration assays. Collectively, these data indicate that BACH1 and c-MET are both necessary for the regulation of EMT and migration in HNSCC. Our data suggest the potential for combination therapy targeting both c-MET and BACH1 to reduce HNSCC metastasis.

Primary Presenter

K. Davis Brock

Status

Graduate

Authors

K. Davis Brock

Bok-Soon Lee

Jiyoung Lee

Research Mentor/ Department Chair

Jiyoung Lee

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

An In Silico Model of Viral Dynamics after Virus-Specific T cell Therapy in Immunocompromised Patients

Immunocompromised patients, including transplant recipients, are at increased risk of serious health complications and mortality following viral infection. Virus-specific T cell (VST) therapy has been an effective approach to treat viral infections, such as Cytomegalovirus (CMV) and adenovirus (AdV) in immunocompromised patients. Studies of VST therapy have shown 70-90% response rates, indicating the viability of the approach. However, variable antiviral responses are observed even in patients receiving identical VSTs. An in silico model to predict the likelihood of therapy success will improve future therapeutic decisions.

The change in viral load during infection is typically described as the initial increase in viral load, the virus saturation, and the viral decay. Prior models have utilized Ordinary Differential Equations to describe these dynamics; however, most are focused on untreated viral infection and or aim to model viral clearance. These existing viral load models do not predict non-response, which we believe is due to the lack of proper effector cell estimations. Additional published work from the Bollard lab has shown that a reduced pre-treatment T cell receptor (TCR) clonotype diversity and frequency occurred in VST non-responders compared to responders. We estimate TCR diversity as the Shannon Entropy. Given the prior work that shows a correlation between pre-treatment TCR diversity and response, we hypothesize that the incorporation of pre-treatment TCR diversity into an in silico Ordinary Differential Equation (ODE)-based model of viral dynamics will improve the model accuracy, in particular for non-responders, and enable better prediction of viral dynamics.

Our preliminary results show a) further correlation between pre-treatment TCR diversity and VST therapy response, and b) the accuracy of an ODE-based model applied to patients treated with VSTs for AdV infection. Together these results indicate the value of pre-treatment TCR diversity in determining the likelihood of viral clearance with VST treatment and the application of an in silico model in the clinical setting.

Virus infected immunocompromised patients are at severe risk of morbidity and mortality. Our approach addresses the lack of in silico models for the outcomes of VST-treated patients, which can be applied to predict how a patient responds to VST treatment and how the TCR repertoire plays a role in such response. Using the patient's viral load and TCR diversity pre-treatment, we can apply the improved set of ODEs to predict the likelihood of viral clearance with VST therapy.

Primary Presenter

Pamela Chansky

Status

Graduate

Authors

Pamela Chansky

Wei Li

Michael Keller

Catherine Bollard

Research Mentor/ Department Chair

Catherine Bollard

Wei Li

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Role of the Cranial Mesenchyme in Neural Tube Defects

Neural tube defects (NTDs) are among the most common structural birth defects leading to long-term disability and death. NTDs result from a failure of neural tube closure as the flat neural plate rolls into a tube to form the central nervous system. This process requires morphogenesis of both the neural plate and the underlying cranial mesenchyme (CM). The CM is derived from paraxial mesoderm (PM-CM) and neural crest (NC-CM) lineages, and both are implicated in NTDs.

While the cellular movements and shape changes that drive morphogenesis within the neural plate are well characterized, how morphogenesis of the CM contributes to neural fold elevation and the respective contribution of the PM-CM and NC-CM remains poorly understood. My project will test the hypothesis that the expansion of the CM is a driving force for the elevation of the neural folds and elucidate the underlying molecular mechanisms.

Movement of the CM was observed using simultaneous multi-view (or SiMView) light-sheet microscopy and analyzed using Imaris microscope imaging software. Previous data in the lab utilized a CM explant assay to demonstrate that increased CM movement is linked to NTDs in the *Hectd1* mutant mouse model. My experiments used this assay and lineage tracing to determine whether PM-CM or NC-CM is the migratory population in the CM. Additionally, RNAseq data were analyzed during neural fold elevation to identify changes in gene expression that correlate with morphogenesis.

Our live imaging studies indicate that cells move in a dorsal lateral direction during neural fold elevation consistent with cells pushing the neural folds to elevate. Explant assays suggest that NC-CM cells migrate in wild-type embryos and eHSP90 secretion is causing increased movement in mutant embryos. Future experiments will explore the cell lineages migrating in the *Hectd1* mutant, the molecular and cellular mechanisms responsible, and how these changes disrupt neural fold elevation.

Primary Presenter

Claire Charpentier

Status

Graduate

Authors

Claire Charpentier

Irene Zohn

Research Mentor/ Department Chair

Irene Zohn

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Enhancing Chimeric Antigen Receptor T (CAR T) cell therapy for glioblastoma using nanoparticle-based photothermal therapy

Glioblastoma multiforme (GBM) remains one of the most malignant brain tumors in adults. Chimeric antigen receptor (CAR) T cell therapy, which involves the adoptive transfer of genetically modified T cells expressing a CAR that recognizes and kills specific antigens on the surface of cancer cells, has been considered a promising treatment strategy for GBM. However, its efficacy has been limited in GBM due to the paucity and heterogeneity of tumor-associated antigens. Advances in nanomaterials as agents of photothermal therapy (PTT) may potentially overcome these challenges with biological heterogeneity and in combination with CAR T cells, serve as a curative multimodal therapy. PTT employs the use of nanomaterials to absorb near-infrared (NIR) light and convert it to heat in a localized and minimally invasive manner. Our group has demonstrated that Prussian blue nanoparticle (PBNP)-based PTT ablates tumors without systemic toxicity, promotes immune cell engagement through the exposure and release of damage associated molecular patterns (DAMPs), and enhances the impact of immunotherapies when used in combination. Among DAMPs, our data shows that PBNP-PTT induces membrane heat shock protein 70 (mHsp70), a prognostically significant marker in primary GBM. Given these observations, we propose that PBNP-PTT can prime the tumor microenvironment (TME) for improved targeting and killing by an Hsp70 CAR as a combination therapy for GBM.

To determine the optimal thermal window for modulating mHsp70 expression, we first evaluated induction of tumor cell death and mHsp70 upregulation by PBNP-PTT on GBM lines U87 and SNB19 at varying thermal doses. We validated that mHsp70 expression and cell death correlates with increasing thermal dose in PBNP-PTT treated GBM cell lines by flow cytometry. Furthermore, time kinetic experiments suggest that mHsp70 is expressed within hours of PBNP-PTT and declines 24 hours following treatment. We then developed an Hsp70 CAR to test whether primary T cells can be genetically modified to target mHsp70. Integration of the Hsp70 CAR was accomplished using lentiviral vectors, and transduction efficiencies of ~70% were achieved over multiple experiments from normal donors. Efforts to assess binding and reactivity are ongoing to determine if additional modifications are needed to optimize the function of our Hsp70 CAR before evaluating the combination therapy. Nevertheless, the proposed use of PBNP-PTT for enhancing CAR T cell therapy introduces a paradigm shift to the current therapeutic landscape of GBM and may demonstrate a novel treatment regimen for a largely incurable disease.

Primary Presenter

Samantha Chin

Status

Graduate

Authors

Palak Sekhri

Jie Chen

Elizabeth Sweeney

Rohan Fernandes

Research Mentor/ Department Chair

Rohan Fernandes

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Astrocytic cellular senescence in the subfornical organ during Ang-II-induced hypertension

Hypertension affects nearly half of US adults and is a leading cause for heart attack and stroke. Angiotensin II (Ang-II) is a well-recognized driver of hypertension, particularly through its sympathoexcitatory actions within the central nervous system (CNS). As a peptide hormone, Ang-II is too large to cross into the brain and acts at circumventricular regions lacking a blood-brain-barrier, particularly the forebrain subfornical organ (SFO). While Ang-II has been shown to drive pro-hypertensive cellular stressors in the SFO (i.e. oxidative and endoplasmic reticulum stress), it is unclear how these mechanisms translate into long-term alterations at the cellular level. Intriguingly, stress-associated pathways can induce cellular senescence and the senescence-associated secretory phenotype (SASP). Chronic senescence/SASP leads to detrimental changes in cell metabolism, macromolecule damage, and a pro-inflammatory environment capable of propagating senescence. We previously demonstrated cellular senescence at the mRNA level, including robust upregulation of the key senescence mediator p16 (*CDKN2A*), in the SFO during Ang-II-induced hypertension. However, the cell type(s) that undergoes senescence in response to Ang-II remains unknown. Thus, we hypothesized, that Ang-II would elicit cellular senescence at the protein level and furthermore that this would occur in both SFO neurons and astrocytes. To test this, male C57Bl/6J mice were implanted with subcutaneous osmotic minipumps for chronic infusion of Ang II (600 ng/kg/min) for 0 or 14 days (n=4-5/group), and brains were collected and prepared for histological evaluation. Immunohistochemical analysis revealed a marked ~46% increase in p16 intensity throughout the SFO following 14 days of Ang-II infusion (Integrated density: 1.00 ± 0.08 vs 1.46 ± 0.24 , Day 0 vs Day 14, $p=0.07$), which was present throughout the rostral to caudal SFO, most notably in the medial region. We next sought to characterize the SFO cell types that undergo cellular senescence using double immunohistochemistry for p16 and either neurons (NeuN) or astrocytes (GFAP). Following 14 days of Ang-II administration and histological procedures, colocalization analysis was performed using IMARIS software. When first examining neuronal populations, extremely low to no co-localization with p16 was found (p16/NeuN: Pearson's correlation coefficient=-0.074, Mander's overlap coefficient=0.071). However, p16 was very highly co-localized with astrocytes (p16/GFAP: Pearson's correlation coefficient=0.545, Mander's overlap coefficient=0.992). Together, these findings indicate that: 1) p16-associated cellular senescence occurs at the protein level in the SFO during Ang-II-induced hypertension; and 2) p16 is primarily upregulated in SFO astrocytes, but not neurons, during hypertension development.

Primary Presenter

Samantha A. Dow

Status

Graduate

Authors

Samantha A. Dow

Colin N. Young

Research Mentor/ Department Chair

Colin N. Young

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Nanomaterial-enhanced immune cells for targeting persistent HIV reservoirs

Background: Antiretroviral drugs suppress HIV replication but fail to fully eliminate the virus which persists in latently infected cells. Latent “reservoirs” lead to co-morbidities and necessitate lifelong adherence to current HIV medications. Strategies such as “shock and kill” reactivate latent HIV, priming the reservoir cells for subsequent killing by the host immune response. However, host immunity is often dysfunctional in people living with HIV. The adoptive transfer of Natural Killer (NK) immune cells represents an attractive solution, as NK cells may circulate to sites of HIV reservoir, kill virally infected targets, and resist infection by HIV. NK cells also express receptors that engage antibodies bound to HIV-infected cells to activate an antibody-dependent killing mechanism. NK cell therapies alone may be ineffective, however, due to insufficient viral reactivation and/or poor availability of HIV-specific antibodies. Here, we use nanoparticle depots to co-deliver latency reversing agents (LRAs) and anti-HIV broadly neutralizing antibodies (bNAbs) to enhance NK cell killing of latent HIV-infected cells.

Hypothesis: We hypothesized that the release of LRAs and anti-HIV bNAbs in the presence of latent HIV-infected cells and NK cells will reactivate virus and elicit enhanced cytotoxic activity from NK cells.

Methods: We synthesized poly(lactic-co-glycolic) acid (PLGA) nanoparticles encapsulating TNF- α and the broadly-neutralizing antibody (bAb) 3BNC117. Nanoparticles were visualized by SEM, while size and charge were quantified by dynamic and electrophoretic light scattering, respectively. Release of encapsulated cargo in various solvents was quantified over time by ELISA. Latency reversal and antibody binding were determined by flow cytometry. Antibody neutralization was determined by a luminescence-based infection reporter assay. To investigate the cytotoxicity of loaded nanoparticles and NK cells on latently HIV-infected cells, ACH-2 cells were co-cultured with combinations of nanoparticles and NK92 cells.

Results: TNF- α and 3BNC117 efficiently encapsulate in PLGA nanoparticles and retain their respective capacities to reactivate and neutralize latent HIV. Nanoparticles co-encapsulating TNF- α and 3BNC117 significantly enhance NK-mediated killing of HIV+ ACH-2 cells when compared to free administration without nano-formulation.

Conclusion: *In vitro*, the concerted action of LRAs and bNAbs enhances NK92 cytotoxicity against latent HIV-infected ACH-2 cells. Orchestrating the synergy of these therapeutic mechanisms may potentially serve as a replacement or adjuvant to current antiretroviral therapy, significantly improving quality of life for people living with HIV.

Primary Presenter

Joshua Ghofrani

Status

Graduate

Authors

Joshua Ghofrani

Jie Chen

Kondareddy Cherukula

Allan B. Bowen

Allison B. Powell

Preethi Balakrishnan

Conrad R. Y. Cruz

Alberto Bosque

Rebecca Lynch

Elizabeth E. Sweeney

Rohan Fernandes

Research Mentor/ Department Chair

Rohan Fernandes

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Generation of syngeneic multi-antigen specific murine T cells for ovarian cancer using Prussian Blue nanoparticles and photothermal therapy

The immunosuppressive nature of ovarian cancer (OC) allows these tumors to evade the immune system, contributing to late-stage diagnoses and poor clinical outcomes for patients with OC. However, it is known that a higher number of tumor infiltrating lymphocytes is associated with improved clinical outcomes in OC. One type of lymphocyte, the T cell, can traffic to the tumor and kill tumor cells. Our collaborators have shown that treating tumor cells with Prussian Blue nanoparticles and photothermal therapy (PBNP-PTT) results in immunogenic cell death, a form of cell death that is visible to the immune system, particularly T cells. We hypothesized that T cells isolated from healthy mice could be expanded to recognize OC cells derived from the same genetic background (syngeneic) as the healthy T cells. While this method of expanding tumor-specific T cells has been done using healthy human T cells that are partially genetically matched to human tumor cells, it has not been done with murine cells. Additionally, a syngeneic setting would expand our understanding of the efficacy, functionality, and persistence of these T cells *in vivo*. By using PBNP-PTT to elicit tumor cell death, we can expand T cells specific for multiple OC antigens, reducing the chance of tumor immune escape that occurs with single antigen specificity.

To test the hypothesis that syngeneic multi-antigen specific T cells recognizing OC cells could be generated using murine cells, we first validated that PBNP-PTT caused immunogenic cell death in OC cells. We determined that PBNP-PTT on the murine OC cell line ID8 B resulted in protein levels of calreticulin, Hsp70, and extracellular ATP, indicative of immunogenic cell death. To determine which anatomical site would yield the most numerous and functional dendritic cells (DCs), we then compared DCs from three anatomical sites in healthy C57BL/6 mice. Measurement of activated surface protein levels on these DCs showed that bone marrow was the optimal source of DCs. We then loaded these bone marrow-derived DCs with PBNP-PTT treated ID8 B cells and co-cultured them with T cells isolated from two anatomical sites. T cells isolated from the spleen were the most optimal, however, spleen-derived T cells were not specific for ID8 B cells. Current protocol optimization efforts include enhancing DC antigen-presenting capability and adjusting T cell cytokines. These efforts serve as a novel approach to study the behavior of multi-antigen-specific OC cells in a syngeneic, *in vivo* setting.

Primary Presenter

Erin E. Grundy

Status

Graduate

Authors

Samantha Chin

Melissa H. Beaty

Olivia Cox

Abigail Lee

Palak Sekhri

Jie Chen

Satish Noonepalle

Maria del mar Gracia Hernandez

Rohan Fernandes

Katherine B. Chiappinelli

Research Mentor/ Department Chair

Katherine B. Chiappinelli

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Characterization of a novel PTPN1 and PTPN2 inhibitor

The signal transducer and activator of transcription (STAT) family of proteins is a group of transcription factors that have been identified to play key modulatory roles in main cellular processes including differentiation, proliferation, and survival. STAT activation occurs via a signaling cascade which is triggered by stimulation with external stimuli, including interleukins, interferons, insulin, prolactin, or growth hormone, and results in STAT tyrosine phosphorylation, dimerization, and nuclear translocation. We have previously identified a small molecule, 3-Hydroxy-1,2,3-Benzotriazin-4(3H)-one (HODHBt) that enhances γ -cytokine signaling by increasing phosphorylation and transcriptional activity of STAT5. In this work, we aimed to characterize the target(s) of HODHBt to develop novel candidates for strategies aimed towards treatment of different diseases associated with dysregulation of STAT function such as type-II diabetes, obesity, infectious diseases, or cancer. We first used cellular thermal shift assay following by mass-spectrometry (CETSA-MS) to identify binding partners of HODHBt in human peripheral blood mononuclear cells and K562 cells. Second, we used STRING pathway analysis to identify interactions of these proteins with STAT5. We then used CRISPR/Cas9 to confirm the role of these proteins in STAT5 phosphorylation and transcriptional activity. Next, we used an *in vitro* enzymatic assay to demonstrate the role of HODHBt inhibiting the catalytic domain of the targets. Finally, we evaluated the effects of HODHBt in CD8T cells. CETSA-MS following STRING pathway analysis identified a unique cluster of interacting proteins with STAT5 including the adaptor protein CRKL, and the non-receptor phosphatases PTPN1 and PTPN2. CETSA followed by western blot confirmed the interaction of HODHBt with PTPN1 and PTPN2. CRISPR/Cas9 studies demonstrated that knock-out of both PTPN1 and PTPN2 increased STAT5 phosphorylation and transcriptional activity in a synergistic manner. PTPN1 and PTPN2 have recently been shown to function as intracellular checkpoint inhibitors in multiple immune cell types. We demonstrated that inhibiting PTPN1 and PTPN2 with HODHBt enhanced cytokine mediated expansion and effector function of CD8T cells. In conclusion, we have identified PTPN1 and PTPN2 as the targets of the small molecule HODHBt. In the future, we will use this knowledge to further develop inhibitors against these phosphatases to functionally manipulate STAT activation as a means to treat diseases where STAT dysregulation is a known cause.

Primary Presenter

J. Natalie Howard

Status

Graduate

Authors

Thomas D Zaikos

Callie Levinger

Esteban Rivera

Marta Sanz

Dennis C Copertino

Weisheng Wang

Xabier Arias-Moreno

Natalia Soriano-Sarabia

R. Brad Jones

Alberto Bosque

Research Mentor/ Department Chair

Alberto Bosque

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Transient upregulation of CD4 increases permissibility of V δ 1 T cells to HIV-1 Infection

The human gammadelta ($\gamma\delta$) T lymphocyte subset V δ 1 T cells populate both peripheral blood and tissues with high rates of HIV replication such as lymph nodes (LNs). During early HIV infection peripheral V δ 1 T cells expand. Although the majority of $\gamma\delta$ T cells do not express CD4, we previously demonstrated that other subsets upregulate CD4 following activation and become permissible to HIV infection. Therefore, we hypothesized that activated V δ 1 T cells also upregulate CD4 expression increasing their permissibility to HIV entry and subsequent latent infection.

Peripheral blood mononuclear cells (PBMCs) were isolated from ART-suppressed people living with HIV (PLWH) and HIV-seronegative donors. LNs were obtained from the National Disease Research Interchange. A single cell suspension was obtained from LNs after mechanical disruption. Modulation of CD4, CCR5, and CXCR4 on circulating V δ 1 T cells was assessed in time-course experiments by flow cytometry. Separately, both PBMCs and LN cells were activated with 3 μ g phytohemagglutinin and 100U/mL IL-2 for 48 hours prior to exposure to HIV variant JR-CSF for seven days. In some cultures, CD4 was blocked using a monoclonal antibody (α CD4) prior to infection. HIV DNA was measured within V δ 1T cells and resting CD4 T cells from PLWH by droplet digital PCR (ddPCR).

V δ 1 T cells had a mean *ex vivo* expression of 3.7% CD4 and 21.1% CCR5 compared to conventional CD4+ T cells which had mean CCR5 of 5.7%. Both cell types had similar relative expression of CXCR4. CD4 expression increased in V δ 1 T cells following activation, peaking between 3-6 days, and declined thereafter. We found that both peripheral and tissue V δ 1 T cells were permissible to infection *in vitro*. Infection was inhibited by the presence of α CD4. HIV *pol* DNA was detected in circulating V δ 1 T cells in ART-suppressed PLWH.

Our results indicate that HIV infection of V δ 1 T cells is CD4-dependent similar other T cell populations. Upregulation of CD4 within V δ 1 T cells is transient following activation suggesting a potential window of opportunity where they are most susceptible to infection. Successful infection of tissue V δ 1 T cells *in vitro* and detection of HIV DNA *ex vivo* necessitates further investigation into their potential role as a latent viral reservoir.

Primary Presenter

Brendan Mann

Status

Graduate

Authors

Brendan Mann

Marta Sanz

Kayley Langlands

Marc Siegel

Natalia Soriano-Sarabia

Research Mentor/ Department Chair

Sanjia Maggirwar

Natalia Soriano-Sarabia

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Molecular biomarker data collection, standardization, and integration for translational research

Biomarkers are valuable clinical and investigative tools, which comprise some characteristic objectively measured as an indicator of normal biological or pathogenic processes, or of responses to a therapeutic intervention. Biomarkers can be used to diagnose disease or track a response to therapy, as well as to observe alterations of key cellular functions that pertain to disease. Surprisingly, systematic organization of biomarker-centric data and its related molecular or clinical knowledge remains underdeveloped. Computational representation of biomarkers is very heterogeneous across resources and studies. Thus, a need exists for biomarker data to be harmonized, standardized, and integrated for translational use. Cancer biomarkers are important in diagnosing and predicting cancer risks and outcomes. A standardized cancer biomarker table would aid in translational research by allowing comprehensive data on biomarkers being readily available. Clinical researchers and clinicians would benefit from a biomarker table by finding information that would help in identifying biomarkers that are similar between cancer types and if particular biomarkers can point to comorbidities. Automated extraction and curation of cancer biomarker data from selected public resources into an integrated dataset was tested; target resources included [Open Targets](#), [GWAS Catalog](#), and [MarkerDB](#). Specific, minimally necessary types of biomarker data (assessed_biomarker_entity, biomarker_status, and condition_name) could be directly mapped into the dataset from all selected resources and then leveraged to extract additional data that provides valuable contextual information; e.g., specimen, biomarker type (e.g., diagnostic), entity type (e.g., gene), etc. Cancer biomarker data extracted from the selected resources include: 1,298 biomarkers from Open Targets, 10,040 biomarkers from GWAS Catalog, and 9,111 biomarkers from MarkerDB. Accurate data mapping (20,449 total biomarkers) from the selected resources indicated both technical and scientific feasibility of automated curation of cancer (and other disease) biomarker data into a comprehensive biomarker dataset. Extraction and harmonization of cancer biomarker data from [ClinVar](#) and [ClinGen](#) is currently in progress.

Primary Presenter

Daniial Masood

Status

Graduate

Authors

Raja Mazumder

Daniel Lyman

Research Mentor/ Department Chair

Raja Mazumder

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Advances in Anti-CD137 Coated Prussian Blue Nanoparticles as Immunostimulatory Photothermal Agents for Melanoma

Background: Photothermal therapy (PTT) is the ablative killing of tumor cells using laser exposure and photothermal agents (e.g., nanoparticles). Alongside tumor cell killing, PTT triggers tumor antigen release and immunogenic cell death (ICD). Despite these beneficial effects, PTT alone is typically insufficient for a robust antitumor response, especially against metastasized cancer. To bolster these antitumor immune responses, PTT has been combined with co-stimulatory antibodies (e.g., anti-CD137; α CD137) with promising effects in syngeneic murine models. While the co-administration of co-stimulatory antibodies such as α CD137 with PTT has improved therapeutic responses in vivo, dose-dependent toxicities of these antibodies remain a major barrier to their clinical translation. Motivated by this need to improve therapeutic responses with improved toxicity profiles, we explore the potential of Prussian blue nanoparticles (PBNPs) to serve as both photothermal agents and vehicles to administer agonistic α CD137 while testing their efficacy in an SM1 melanoma model. We hypothesize that PTT-based tumor ablation concomitantly with direct stimulation of the costimulatory receptor CD137 will yield improved outcomes for treating melanoma while also mitigating α CD137-mediated toxicity.

Methods: PBNPs were synthesized from $K_4[Fe(CN)_6]$ and $FeCl_3$. PBNPs were coated with α CD137 via electrostatic binding to yield α CD137-PBNPs. To evaluate the PTT/ICD/co-stimulatory properties of α CD137-PBNPs in vitro, 5 million SM1 cells were suspended in tubes and administered PTT at varying laser powers. For in vivo studies, 5-week-old C57BL/6 mice were inoculated with 1 million SM1 cells and left untreated or treated with intratumoral (i.t.) or intraperitoneal (i.p.) α CD137 (3 doses), i.t. α CD137-PBNPs (3 doses), PBNP-PTT, or α CD137-PBNP-PTT + 2 boosters of i.t. α CD137-PBNPs. α CD137 was administered at 1.125 mg/kg/dose.

Results: In vitro, we observed that α CD137-PBNP-PTT increased cell surface expression of calreticulin and increased release of HMGB1 and ATP, which are markers of ICD. In vivo, untreated mice reached their tumor endpoints within 15-23 days. Complete tumor regression (on Day 40) was observed in 20% of mice treated with i.p. α CD137 or i.t. α CD137-PBNPs, 40% of i.t. α CD137-treated mice, 10% of PBNP-PTT-treated mice, and 50% of mice treated with α CD137-PBNP-PTT. Importantly, we observed improved hepatotoxicity profiles only in long-term surviving mice treated with α CD137-PBNP-PTT plus two boosters of i.t. α CD137-PBNPs. Conclusion: We have demonstrated that α CD137-PBNPs can serve as photothermal agents that can both elicit ICD in vitro and eliminate primary tumors in vivo. We have also observed that α CD137-PBNP-PTT can mitigate toxicity. Our ongoing studies are evaluating the immunological effects of α CD137-PBNP-PTT.

Primary Presenter

Jacob A Medina

Status

Graduate

Authors

Debbie K. Ledezma

Jie Chen

Preethi B. Balakrishnan

Elizabeth E. Sweeney

Rohan Fernandes

Research Mentor/ Department Chair

Rohan Fernandes

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Evaluating the ability of the antibody Fc-region to promote memory-like NK cells

Human-immunodeficiency virus (HIV) infection is still a leading cause of mortality and morbidity worldwide. Natural Killer (NK) cells play an important role in controlling HIV infection. Importantly, different studies highlight the potential of harnessing NK cells to develop a protective HIV vaccine or a cure. Recently, NK cells have been shown to have 'memory-like' properties, both antigen dependent or independent. In the context of HIV, pre-existing memory-like NK cells have been shown to control viremia during primary infection. As such, understanding the signaling pathways and mechanisms promoting the generation of memory-like NK cells could lead to the development of therapeutic strategies to enhance HIV control mediated by memory-like NK cells. In humans, memory-like NK differentiation occurs either by cytokine stimulation (IL-12, IL-15 and IL-18); Fc γ RIIIa(CD16)/CD2 co-stimulation or previous vaccination with the live attenuated *Mycobacterium bovis*. In this work, we investigated the potential of monoclonal antibodies (mAbs) to induce memory-like NK cells through the stimulation of CD16 receptors. We used VRC07-523 IgG1 and VRC07-523-GRLR IgG1, a mutant that abrogates Fc binding to CD16, to study the efficacy of mAbs to promote memory. First, we evaluated the ability of mAbs to promote NK activation. We pre-coated 24 well plates overnight with mAbs. The next day, NK cells were negatively isolated from peripheral blood mononuclear cells and activated overnight with the mAbs in the presence of IL-12, IL-15, and/or IL-18. The following day, activation and IFN- γ production were measured by flow cytometry. We confirm that VRC07-523 alone was able to promote activation and IFN- γ production while VRC07-523-GRLR did not (n=5). A combination of cytokines IL12, IL15 and IL18 enhanced the ability of the mAb to promote both NK activation and IFN- γ production. We then measured whether mAb-activated NK cells can generate memory-like cells. Activated NK cells were kept in culture for 7 days in the presence of low IL-15, as previously described. At day 7, NK cells were restimulated with IL12 and IL15 for 6 hours and IFN- γ production was measured by flow cytometry. In spite of promoting activation, mAb alone or in combination with different cytokines was not sufficient to enhance memory generation. Experiments are ongoing to evaluate whether activation of NK cells with mAbs changes their effector function against HIV-infected cells. In conclusion, understanding the long-term effects of bNAbs binding to NK cells through CD16 could help designing therapeutic strategies to improve control of HIV by NK cells in the context of bNAb therapies.

Primary Presenter

Claudia Melo

Status

Graduate

Authors

Teresa Murphy

Bridget Dwyer

Rebecca Lynch

Alberto Bosque

Research Mentor/ Department Chair

Alberto Bosque

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Eco-HIV Infected CHME5 as a Novel *in vitro* Model for HIV Infection and Latency in Microglia

Human immunodeficiency virus (HIV), is a retrovirus that can infect multiple reservoirs in the body, including microglial cells within the central nervous system (CNS). HIV infection in microglia likely assumes a state of latency, in which HIV is transcriptionally silent in the host genome. HIV latency is a major barrier to an HIV cure since current anti-retroviral therapy cannot target latently infected cells. To better understand HIV infection and latency, researchers have turned to *in vitro* microglia cultures. However, studying CNS resident cells *in vitro* can be difficult since patient samples are not readily available. Some models for studying HIV infection *in vitro* include human induced pluripotent stem cell-derived microglia (iPSC-MG), primary microglia, immortalized microglia, and monocyte-derived microglia (MMG). iPSC-MG and primary microglia are great HIV infection models, but they are expensive and non-dividing, thus limiting sample pool sizes. While immortalized (human and mouse) and MMG models are less expensive alternatives, they lack initial robust HIV infection likely due to the increased presence of SAMHD1, which reduces HIV replication by depleting dNTP pools. SIV-derived Vpx is a known inhibitor of SAMHD1 and Vpx-containing virus-like particles (VLPs) have been used in *in vitro* macrophage cultures to increase HIV infection. In this study, we propose a novel *in vitro* immortalized microglial cell model of HIV infection, EcoHIV-infected CHME5 (rat) cells that are primed with the Vpx VLPs. We utilized flow cytometry, imaging, and western blots, to develop a model of both HIV infection and latency. The latter was confirmed using a range of latency reversing agents (LRAs). Our novel HIV infection model has shown robust infection rates, and consistent latency and reversal of latency. Consistent with macrophage models, we find that initial HIV infection of microglia increases upon treatment with Vpx VLPs, likely due to decreased SAMHD1 levels. We predict that Vpx VLPs will be useful for increasing infection in other myeloid HIV infection models. With this model, researchers can readily investigate new pathways that influence HIV infection and latency in microglia, which will inform future HIV treatment and cure strategies in the CNS.

Primary Presenter

Brita Ostermeier

Status

Graduate

Author

Carles Moreno Soriano

Sanjay B. Maggirwar

Research Mentor/ Department Chair

Sanjay B. Maggirwar

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

The Role of Hydroxyprostaglandin Dehydrogenase in Contralateral Breast Cancer

Most treatments for breast cancer focus on a unilateral tumor, although the incidence and mortality of contralateral breast cancer (CBC), especially in young women, is remarkable. While incidence of unilateral breast cancer increases with age, paradoxically, CBC incidence rates among breast cancer patients younger than 35 years are 5 times higher than those for older patients. CBC affects young patients disproportionately in terms of both incidence and mortality, and is increasing for hormone receptor-negative tumors, thus presenting a clinically unmet need. Little is known about what causes CBC development and how to predict CBC risk. Although some risk factors like family history and germline mutations have been linked to CBC the molecular mechanisms for CBC tumorigenesis are not understood. Preliminary data using patient samples has identified a set of lipid metabolic genes altered in the second unaffected breast from patients with unilateral breast tumors compared to healthy controls. Specifically, transcriptomic profiling of unaffected contralateral breast tissue using preclinical tumor models identified hydroxyprostaglandin dehydrogenase (HPGD) as the top overexpressed gene. We hypothesized that the dysregulation of HPGD in the hormone receptor negative primary tumor leads to the promotion of CBC. Our results showed that human triple negative breast cancer (TNBC) cells overexpressing HPGD increased proliferation compared to controls. In addition, prostaglandin E₂ treatment decreased proliferation and invasion of human and mouse TNBC cell lines expressing low levels of HPGD. Overall, our preliminary results indicate that HPGD increases tumorigenesis of breast cancer. By investigating the underlying causes of CBC focused on HPGD and prostaglandin E₂, we will address the unmet clinical need to help identify novel biomarkers for early detection and better screening for CBC in young breast cancer patients.

Primary Presenter

Joselyn Padilla

Status

Graduate

Authors

Boksoon Lee

Jiyoung Lee

Research Mentor/ Department Chair

Jiyoung Lee

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Sex differences in the selection of stress coping strategy as a predictor of post-stress avoidance behavior

Although the experience of stress is ubiquitous, the development of affective disorders such as generalized anxiety (GAD) and major depressive disorder (MDD) is associated with maladaptive stress responses. GAD and MDD prevalence are higher globally in females than in males, but the precise physiological and behavioral cause of this sex-linked difference in prevalence is unclear. During a stressful experience, an individual may choose to adopt a range of coping strategies, which can be classified as active or passive in their context. In order to probe the relationship between stress coping strategies, sex, and stress-linked behavioral outcomes, we exposed male and female mice to subchronic variable stress and recorded their behavior during stress and post-stress avoidance tasks. We found a higher immobility score ($p = 0.01$) and higher number of mobility bouts in females than males on the second day of tail suspension stress ($p = 0.03$), suggesting that females sustained greater active coping than males over repeated TSS. Furthermore, we found that on the first day of TSS, a higher immobility score was associated with a higher ratio of time spent in the open arms (OA) of the elevated plus maze (EPM) in females ($y = 75.1X - 37.5$, $p = 0.04$), whereas in males, a higher immobility score was associated with a lower OA ratio ($y = -121X + 123.1$, $p = 0.05$). This relationship persisted on day 2 of TSS for females ($y = 100.0X - 63.2$, $p = 0.004$). In the novelty suppressed feeding test, a higher immobility score on day 2 of TSS predicted a lower latency to approach food in females ($y = -1056X + 1028$, $p = 0.01$). There was no significant difference in total distance traveled in the EPM and no correlation between weight change and latency to eat in the NSF. These results suggest that greater active coping predicts greater post-stress avoidance in females, while increased active coping predicts decreased post-stress avoidance in males. We are currently pursuing the specific role of GABAergic neurons in the ventral tegmental area (VTA) during transitions between mobility states as a mediator of stress-induced changes in VTA dopamine neuron activity that drives post-stress avoidance phenotypes.

Primary Presenter

Kailyn Price

Status

Graduate

Author

Kailyn Price

Research Mentor/ Department Chair

Abigail Polter

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Transcriptomic Profiling of Human Cardiomyocyte Maturation from Birth Through Adolescence

The human heart undergoes remarkable developmental changes in the postnatal period, resulting in increased efficiency, contractility, and electrical conduction. Studies suggest that cardiomyocyte maturation is robust during prenatal development and early postnatal life – but myocytes may not fully reach an adult phenotype until nearly the first decade of life. However, to date, there are considerable knowledge gaps in our understanding of cardiomyocyte physiology throughout childhood. A more thorough understanding of pediatric cardiomyocyte physiology can better inform clinical care decisions and the use of age-appropriate drug therapies for young patients.

To investigate developmental changes in cardiac gene expression, using human heart samples collected from children with congenital heart disease.

Acyanotic patients (neonates – young adults) who underwent surgical correction of congenital heart defects, which necessitated cardiopulmonary bypass, were enrolled in the study. Right atrial appendage tissue was collected and stored for analysis. Total RNA was extracted from tissue specimens and global gene expression was analyzed using human Clariom S arrays.

A significant number of genes were differentially expressed in infants (<1 year) (2156 genes downregulated and 2138 genes upregulated) compared to young adults (>12 years) ($p < 0.05$; fold change ± 1.5). Genes involved in focal adhesion, collagen synthesis, striated muscle contraction, metabolism were among the most differentially expressed. Transcriptomic data was then used for computational modeling to predict developmental changes in the cardiac action potential. Preliminary results predict patient-specific changes in action potential morphology in acyanotic infants (<1 year) compared to young adults. Our results show human cardiomyocytes undergo dynamic changes during childhood, which can influence cardiac electrophysiology and contractility. Accordingly, pediatric patients may experience different responses to pharmacological drugs based on age and disease.

Primary Presenter

Shatha Salameh

Status

Graduate

Authors

Shatha Salameh

Devon Guerrelli

Nikki Posnack

Research Mentor/ Department Chair

Nikki Posnack

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Oncogenic *Kras*^{G12D} and *Cdkn2a/p16* knockout in LGR5 expressing progenitor cells synergize to advance adenoma and adenocarcinoma phenotypes in murine small intestine

KRAS activating mutations are reported in 42-54% and inactivation of *CDKN2A/p16* in 14-30% of human small intestinal adenocarcinomas, suggesting a role in small intestine adenocarcinogenesis. The phenotypic effects of oncogenic *KRAS* and p16 loss have not been well characterized in small intestine (SI) adenocarcinogenesis. We targeted LGR5-expressing progenitor cells residing in intestinal crypts for conditional activation of *Kras* and/or *Cdkn2a/p16* deletion to generate a murine model to study the single and combined effects of *KRAS* and p16 alterations driving gastrointestinal tumorigenesis. We hypothesized that oncogenic *Kras* and loss of *Cdkn2a/p16* drives adenoma-adenocarcinoma sequence in murine SI. We generated conditional knockout of *Cdkn2a/p16* ($p16^{del}: IL1b^{wt/tg};Lgr5-Cre^{+/-};p16^{fl/fl};Kras^{wt/wt}$), conditional expression of oncogenic *Kras*^{G12D} ($IL1b^{wt/tg};Lgr5-Cre^{+/-};Kras^{G12D/wt}$), or both alterations ($p16^{del+Kras^{G12D}}: IL1b^{wt/tg};Lgr5-Cre^{+/-};p16^{fl/fl};Kras^{G12D/wt}$), in mice carrying the human interleukin 1 beta (IL1B) and expressing modified Cre under the *Lgr5* promoter. Our control murine model expresses wild type p16 and *KRAS* ($p16^{wt+Kras^{wt}}: IL1b^{wt/tg};Lgr5-Cre^{+/-};p16^{wt/wt};Kras^{wt/wt}$). These mice were initially generated to study esophageal adenocarcinogenesis and express the *IL1b* transgene in esophagus but not in SI. All mice were given bile acid in drinking water daily and were treated with tamoxifen to activate Cre in *Lgr5*-positive gastrointestinal epithelial progenitor cells. Mice were euthanized and gross and histologic alterations in the SI were examined from 4 to 21 months of age. 3D organoids were isolated from the SI of each mouse model. We examined 89 mice from 4 to 12 months of age. Mice with *KRAS* activation (*Kras*^{G12D}) alone infrequently developed SI duodenal adenomas (6.25%: 1/16) compared to 50% (9/18) of mice carrying the combined *P16*^{del+Kras}^{G12D} genotypes (P=0.005). No adenomas were seen in 27 control and 28 *p16*^{del} mice. Adenomas with high-grade dysplasia, intramucosal adenocarcinoma, and invasive adenocarcinoma were seen only in older *p16*^{del+Kras}^{G12D} mice (13-21 months). Single or multiple adenomas and adenocarcinomas were observed only in the duodenal segment of SI and not in the colon. 3D organoids isolated from each mouse model reproduce the intestinal histologic phenotype. Loss of *Cdkn2a/p16* and *KRAS*^{G12D} expression synergistically advances adenoma-adenocarcinoma tumorigenesis in the SI duodenum, providing a murine model that recapitulates SI adenocarcinogenesis *in vivo*. 3D SI organoids provide useful *in vitro* models for mechanistic studies of SI adenocarcinogenesis. These *in vivo* and *in vitro* models will enable identification of key molecular pathways that may be targeted with novel therapies for this rare cancer.

Primary Presenter

Tyler Seckar

Status

Graduate

Authors

Tyler Seckar

Jing Sun

Elena Komissarova

Jorge Sepulveda

Timothy Wang

Antonia Sepulveda

Research Mentor/ Department Chair

Antonia Sepulveda

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

Safety and Antiviral Response Monitoring Post Infusion of Autologous HIV-Specific T Cells Targeting Non-Escaped Epitopes in Individuals with HIV on Antiretroviral Therapy: A Phase I Clinical Trial (NCT03485963)

The advent of antiretroviral therapy (ART) has improved clinical outcomes for people living with HIV (PLWH), however latent HIV reservoirs in CD4+ T cells is a limitation in HIV eradication. While T cell immune responses have shown to be critical in HIV control, viral immune escape mutations limit T cell mediated anti-HIV immunity. Thus, T cell therapy targeting non-escaped HIV epitopes is a promising treatment strategy for PLWH. In a phase I clinical trial, we evaluated the safety, immunologic and virologic responses of a novel HIV-1 multi-antigen specific T cell therapy (HST-NEET) targeting HIV Nef and conserved epitopes of Gag and Pol in people with HIV suppressed on ART. We hypothesized that T cells targeting HIV non-escaped epitopes would expand and persist in HIV+ individuals following T cell infusion and elicit anti-viral effects. Six participants with HIV (ages 33-57 years, 3 males and 2 females identifying as African or African American, 1 male identifying as White) received two infusions (2×10^7 cells/m² BSA/dose) of HST-NEETs without prescribed lymphodepletion and without severe infusion-related toxicities. HST-NEET infusions were safe and well tolerated. Follow-up was conducted over the course of 13-15 clinic visits pre- and post-infusions. HST-NEET infusion products met clinical dose requirements, with predominantly CD3+CD8+ populations expressing effector memory (86.8-98.4%) markers. HST-NEET products had specificity for 1-3 viral antigens by IFN γ ELISPOT with a dominance of Nef-specific responses, and elicited polyfunctional and polyclonal responses to the antigens by flow cytometry. Epitope mapping of the products identified 13 CD8-restricted known epitopes, including repeated Nef epitopes associated with the HLA-B07 supertype. Participants showed no significant changes in anti-HIV envelope-specific antibody responses over time, except for RESIST006. HIV-specific responses increased post-infusion in some participants. Of note, RESIST003 and RESIST007 showed increased Mos1/2-specific responses in peripheral blood post-infusions. Further, TCR β sequencing of HST-NEETs and post-infusion samples showed that expansion and persistence of shared HIV-reactive T cell clones were associated with marked decreases in HIV reservoir size measured by intact proviruses per 10⁶ CD4+ T cells (INTACT/M). Notably, two participants (RESIST003 and RESIST004) showed a decrease to 0 INTACT/M from 24.4 and 32.1 INTACT/M pre-infusion, respectively. To our knowledge, this is the first clinical study to evaluate the safety, immunologic, and virologic responses of autologous HST-NEETs therapy as a therapeutic strategy for HIV. These findings suggest that this therapeutic may target the latent HIV reservoir responsible for viral rebound in individuals with HIV.

Primary Presenter

Danielle K. Sohai

Status

Graduate

Authors

Michael Keller
Patrick J. Hanley
Anushree Datar
Emily Reynolds
Dennis Copertino
Christopher Lazarski
Chase McCann
Haili Lang
Pamela A. Chansky
Cecilia Motta
Bridget Dwyer
Andrew Wilson
Rebecca Lynch
Winiffer D. Conce Alberto
Zabrina L. Brumme
Natalie N. Kinloch
Conrad Russell Y. Cruz
Lynsay MacLaren Ehui
Sarah Henn
R. Brad Jones
Catherine M. Bollard

Research Mentor/ Department Chair

Catherine M. Bollard

Conrad Russell Y. Cruz

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

The Role of Biological Sex, Age, and Sex Hormones on the Activity of IL-15 in the Context of HIV Cure Strategies

The role of different biological variables including sex hormones, age, and biological sex in HIV cure approaches is not well understood. Previous studies have shown differences in HIV infection by biological sex, as well as differences from sex hormones in both infection and transcription. The γ c-cytokine IL-15 is a clinically relevant LRA that mediates HIV reactivation and promotes immune activation. A recent phase I clinical trial showed the safety and efficacy of the IL-15 superagonist N-803 in people living with HIV. In this work, we examine the interplay that biological sex, age, and sex hormones estradiol, progesterone, and testosterone may have on the biological activity of IL-15. To evaluate effects on latency reversal, we utilized a previously established primary cell model of latency using 10 sex and age-matched donors. To evaluate effects on immune activation, 20 HIV-negative, age-matched donors were used to measure activation of CD4T, CD8T, and NK cells and to measure cytokine secretion using a 10-cytokine array panel. Treatments of estradiol, progesterone, or danazol (a testosterone derivative) were used at three physiological concentrations, reflecting levels found in plasma during the life span. Finally, expression of hormone receptors was measured by western blot and flow cytometry. Sex hormones and age did not influence the ability of IL-15 to reactivate latent HIV in the primary cell model of latency, however there is a trend of higher reactivation in female donors. Moreover, none of the sex hormones tested influenced the ability of IL-15 to promote immune activation or cytokine secretion. Interestingly, IL-15 promoted higher CD4T cell immune activation from female donors than from male donors (Mann-Whitney test, $p=0.029$), but this difference was abrogated at the highest concentration of estradiol tested. Additionally, there was a positive correlation between CD8T cell activation and age (spearman correlation, $r=0.479$, $p=0.033$). Finally, CD4T, CD8T, and NK cells expressed detectable levels of androgen receptor and variable expression of progesterone receptor isoforms. Only CD4T and CD8T but not NK cells expressed detectable levels of estrogen receptor ($ER-\alpha$). Our study has found that biological sex and age, but not sex hormones, influence the biological activity of IL-15. Understanding how different biological variables affect the biological activity of cure therapies will help us evaluate current and future clinical trials aimed towards HIV cure in diverse populations.

Primary Presenter

Carissa Stover

Status

Graduate

Authors

Carissa Stover

Callie Levinger

Marie Abongwa

Cristina Ceriani

Nancie Archin

Alberto Bosque

Research Mentor/ Department Chair

Alberto Bosque

RESEARCH SHOWCASE

BIOMEDICAL SCIENCES

TRIM28 promotes cellular plasticity and modulates the tumor microenvironment in prostate cancer

Prostate cancer is the second leading cause of cancer-related deaths in American men. Castration-resistant prostate cancer, prostate cancer that does not respond to traditional androgen deprivation treatment, has a prognosis of approximately 13 months once diagnosed. Since this more aggressive subtype of prostate cancer does not respond to standard therapy it requires novel treatment strategies. Tripartite motif-containing 28 (TRIM28) is a transcriptional co-factor found to be upregulated in high-grade and metastatic prostate cancers and was recently proposed as a therapeutic target. TRIM28 has been shown to repress transposable elements in embryonic stem cells and has been implicated in indirectly modulating the immune environment in cancer. In prostate cancer cell lines and xenografting studies, TRIM28 deletion is sufficient to decrease tumor burden.

To study the function of TRIM28 in castration-resistant prostate cancer, we inhibited Trim28 in the *Nkx3.1-CreERT2; Pten (floxed); p53 (floxed)* (NPp53) mouse model of prostate cancer. Surprisingly, in this immune-competent mouse model, TRIM28 inhibition did not reduce tumor size. Tumors from hormonally intact mice with *Trim28* deletion (NPp53T) grew larger and more quickly than NPp53 controls. Additionally, castration of mice slowed tumor progression in NPp53 but not NPp53T mice. Histological analysis revealed an androgen-independent reduction in proximal luminal-like cells in *Trim28*-deleted tumors. These cells are thought to contribute to prostate cancer propagation and have progenitor properties, yet their reduction did not slow tumor progression. NPp53T tumors developed an androgen-independent inflammatory response and necrosis in prostate lumens. In hormonally intact NPp53T tumors, we found a shift over time to a more immune-suppressive phenotype.

To investigate the epigenetic effects of *Trim28* deletion in prostate cancer we performed paired-end bulk RNA sequencing. Our results indicate that *Trim28* deletion derepresses the ERV family of transposable elements in prostate cancer in both hormonally intact and castrated mice. In conclusion, our study identifies the complex role of TRIM28 in modulating the tumor microenvironment and repressing transposable elements in castration-resistant prostate cancer. Together, these results provide insight into tumor evolution, and potential methods for sensitizing prostate cancers to immunotherapies.

Primary Presenter

Emily C. Williams

Status

Graduate

Authors

Ashutosh S. Yende

Andrew Pletcher

Tomas Kanholm

Patricia S. Latham

Katherine B.
Chiappinelli

Maho Shibata

Research Mentor/ Department Chair

Maho Shibata

RESEARCH SHOWCASE

CHEMISTRY

An Analysis of Spectral Simulation Methods for Laser Heterodyne Radiometry for the Vertical Profiling of Greenhouse Gas (GHG) Mixing Ratios

George Washington University and Mesa Photonics are developing and deploying a Laser Heterodyne Radiometer (LHR) that simultaneously measures CO₂, CH₄, H₂O, and O₂ mixing ratios throughout the troposphere and lower stratosphere. Spectral fits are constrained by fitting the oxygen spectral line shape – which depends only on pressure and temperature – to improve GHG retrieval precision and provide dry-air corrections. This constraint is achieved by fitting pressure and temperature profiles obtained from the meteorology data measured by radiosondes (vertical resolution ranging from 5-500 m) as part of NOAA's Integrated Global Radiosonde Archive (IGRA).

Atmospheric spectra are simulated for the column using a spectral simulation package (“LahetraSim”) that uses parameters from the HITRAN spectral database to model spectra through the HITRAN Application Programming Interface (HAPI). Integrated path absorption spectra are calculated using the initial sun angle and estimated radiosonde pressure and temperature profiles. Concentration profiles for CO₂, CH₄, and H₂O can then be iterated on their vertical distributions and refining the pressure and temperature profiles to best fit the oxygen spectrum.

Here we present a comparison of our spectral simulation software to that of an alternative method that has been presented for LHR data processing which makes use of the Planetary Spectrum Generator (PSG) API. Spectral simulations are generated using several atmospheric databases, templates, and transfer models. This tool allows for the extraction of Modern Era Retrospective Analysis, Version 2 (MERRA-2) vertical profiles of pressure and temperature and species abundances from HITRAN. Two limitations of the MERRA-2 database are the latency of approximately 2 months for the latest data availability and the coarse vertical resolution (~1 km) of the available data. Another benefit of our approach is that approximation of both Planetary Boundary Layer (PBL) and Tropopause Heights can be extracted from the temperature and pressure profiles and these heights can be iterated to refine atmospheric layers, thus increasing their relevance of LHR to GHG modeling.

Primary Presenter

Monica Flores

Status

Graduate

Authors

J. Houston Miller

David Bomse

Anthony Gomez

Research Mentor/ Department Chair

J. Houston Miller

RESEARCH SHOWCASE

CHEMISTRY

Stereosequence-defined Aromatic Oligoamide Foldamers for Protein Surface Recognition

Protein-protein interactions (PPI) control a variety of cell functions and are linked to diseases such as cancer and neurodegeneration when aberrant. PPIs occur over broad, highly specific surfaces that are difficult to target with small molecule ligands. Peptidomimetic foldamers, chain molecules strategically designed with conformational drivers that shape their folding in solution, represent a promising strategy for the competitive inhibition of PPIs by mimicking a protein's natural binding partner. Significant work has been undertaken to understand how chiral groups drive conformation in helical foldamers, but little has been completed on linear, tape-like structures. To fill this gap, our group has designed and synthesized a monomer for the synthesis of linear aromatic oligomers containing a chiral nPropyl group between monomers that we hypothesized would influence conformation through pseudoaxial strain. To study this effect, we synthesized oligomers with 2-5 monomers and varying stereosequence, the sequence of R and S nPropyl groups along the backbone. Nuclear magnetic resonance and circular dichroism analyses of synthesized oligomers have shown that the stereosequence directly impacts folding and that C-terminal chirality potentially provides a template for folding in higher order oligomers.

Primary Presenter

Nora Houseman

Status

Undergraduate

Authors

Benjamin Kass

Joseph Meisel

Research Mentor/ Department Chair

Joseph Meisel

RESEARCH SHOWCASE

CHEMISTRY

Bioengineering More Functional Enzymes One Amino Acid at a Time

Protein regulation in multicellular organisms is not fully understood as there are many contributing components with diverse functions. Understanding the roles of the zinc-binding proteins in the protein homeostasis of cells may help identify potential causes to developmental disorders like Opitz BBB syndrome. One way that proteins are regulated is through the process of ubiquitination which is responsible for tagging unwanted proteins. Three classes of enzymes are involved in this process of which the zinc-binding B-box1 domain is a member. My project involves understanding how changing specific amino acids on the B-box1 domain of the MID1 protein affects its function. Mutations of the B-box1 domain is an association with Opitz BBB syndrome. For two mutants, the ability of the B-box1 protein to add ubiquitin to itself is a measure of activity level. We have shown that mutating residues Proline at position 151 in the protein sequence to leucine (P151L) resulted in a more active enzyme. Furthermore, a second mutation, Aspartate at 122 to glutamine (D122Q) also increased the activity of the enzyme. These observed increases in ubiquitination activity levels highlight the significance of these amino acids in regulating protein homeostasis during embryo development.

Primary Presenter

Nikhil Kalita

Status

Undergraduate

Authors

Nikhil Kalita

Anupreet Kaur

Michael Massiah

Research Mentor/ Department Chair

Michael A. Massiah

RESEARCH SHOWCASE

CHEMISTRY

The Effect of Cd²⁺-oxo Interactions on Uranyl Electronic Structure

Methods that influence uranyl (UO₂²⁺) electronic structure, and by extension, properties of the uranyl cation, are of particular interest as they provide insight into nuclear waste stewardship. Prior scholarship has comprehensively investigated the effect of equatorial interactions with the uranium atom on uranyl electronic structure. Equatorial coordination with carboxylate and terpyridine-based ligands causes varying degrees of blue-shift to the uranyl emission spectrum. Equatorial coordination with strongly electron-donating ligands promotes halogen interactions at the uranyl oxo. Additionally, previous work done by our group with heterometallic Pb²⁺ and Ag⁺ uranyl compounds has demonstrated that cation-cation interactions between closed-shell metal cations and the uranyl oxo groups (M⁺-oxo interactions) result in a weakening of the U=O bond and quenching of uranyl luminescence. However, this effect was significantly more pronounced for Pb²⁺ than the more polarizable Ag⁺. We use equatorially coordinating chelidamic acid ligands to selectively promote M⁺-oxo interactions in heterometallic UO₂²⁺/Cd²⁺ compounds to study how varying metal cation identity influences the observed property changes caused by closed shell M⁺-oxo interactions. The deprotonation of the alcohol group in chelidamic acid increases its electron-donating strength and can be controlled through pH. Six novel heterometallic UO₂²⁺/Cd²⁺ containing chelidamic acid were synthesized hydrothermally. Nitric acid was used to adjust the initial pH and control the chelidamic acid deprotonation. Single-crystal x-ray diffraction was used to structurally characterize these compounds. This revealed that four of the compounds likely feature Cd²⁺-oxo interactions. These compounds also have the fully deprotonated, strongly electron-donating form of chelidamic acid coordinated to the uranyl. This suggests that the electron-donating strength of the equatorial ligands can be tuned to promote M⁺-oxo interactions. Computational analysis was used to quantify the strength of the interactions and determine the orbitals involved. It also allowed us to quantify the electron-donating strength of the chelidamic acid. This study will also examine property changes caused by Cd²⁺-oxo interactions. Luminescence studies will measure changes to the emission and excitation spectra of the uranyl cation and diffuse reflectance spectroscopy will measure changes to the absorbance spectrum. Comparisons of property changes caused by Cd²⁺ with Pb²⁺ and Ag⁺ will reveal the role of metal identity in changes to UO₂²⁺ electronic structure caused by M⁺-oxo interactions.

Primary Presenter

Ahan Panchal

Status

Undergraduate

Author

Dominique M. Brager

Research Mentor/ Department Chair

Christopher L. Cahill

RESEARCH SHOWCASE

CHEMISTRY

Defining “LEGO” blocks for sustainable chemical design

The chemical industry plays an imperative role in driving sustainable development, however, as a result of the commercialization of hazardous chemicals, the industry has also become a primary contributor to environmental crises. The industry continues to rely on technologies that are outdated and tied to fossil-fuel feedstocks, and because of this, it is unable to respond to change with agility or undertake transformative innovations. To achieve a desired change in developing next-generation chemicals that are high-performing, safe, and degradable, a “ground up” approach is envisioned to develop a novel design framework.

Rather than modifying existing molecules, which often leads to difficult tradeoffs, we assembled a large repository of 137 chemical building blocks from renewable, biobased feedstocks. Subsequently, we used a published machine learning model to predict the landscape of chemical products synthesizable from those biobased starting materials. An algorithm was constructed for an iterative virtual synthesis, where pairwise combinations yielded the first generation of chemical products, which were then ‘reacted’ with the original dataset to produce the second generation of products, and so on. To pick leads from the vast collection of newly generated chemicals, we applied a series of toxicokinetic and toxicodynamic filters, such as relevant physicochemical and pharmacological properties (e.g., molecular volume, globularity, solvent-available surface area, the octanol-water partition coefficient – $\log P_{o/w}$, or aqueous solubility – $\log S$) and binding-affinity scores computed using ligand- and structure-based virtual screening methods.

To continue developing our systems-based modeling framework, we selected a set of 25 pesticides that were known to be strong inhibitors of acetylcholinesterase (AChE), a common pesticide target. To assess physicochemical and pharmacological property cutoffs (i), we relied on the QikProp program which generates a score that is used to rank compounds based on their chemical likeness to commercial pesticides. Using the principles of green chemistry and engineering, in combination with machine learning and quantum-mechanical modeling, we developed a diverse set of innovative, tunable molecules that are more flexible and resilient. Our overall goal is to propose new agrochemicals that mimic the function of existing products based on bio-based building blocks with a desirable footprint.

Primary Presenter

Chaitrali Patil

Status

Undergraduate

Authors

Chaitrali Patil

Geetesh Devineni

Jakub Kostal

Research Mentor/ Department Chair

Jakub Kostal

RESEARCH SHOWCASE

CHEMISTRY

Measuring Protein Turnover in Human Neurons using Mass Spectrometry based Proteomics

Protein turnover is the process of degrading old proteins and synthesizing new proteins. Perturbations in protein turnover can lead to the accumulation of misfolded and aggregated proteins, which is associated with many human diseases, including neurodegenerative disease, cancer, and aging. Regulating protein turnover is especially crucial in neurons due to their inability to divide. Without a way to regenerate, a neuron's death can permanently damage the nervous system. Neurons have traditionally been studied using mouse and rat neuron models; however, these platforms do not exhibit high similarity to live human neurons. Inducible pluripotent stem cells (iPSCs), which have been transformed from skin cells, have been developed as a promising platform to study neuronal biology. To observe the active proteome of iPSC derived neurons, we will utilize the growing media for the cell cultures by performing dynamic Stable Isotope Labeling by Amino acids in Culture (dynamic SILAC). In dynamic SILAC, pre-existing "light" amino acids that make up the proteins in the neuron cells are replaced, overtime, by the "heavy" isotopic amino acids integrated into the cell culture media. The change of "light" to "heavy" proteins results in a detectable mass difference of molecules using Liquid Chromatography-Mass Spectrometry (LC-MS). LC-MS is an analytical tool that allows us to identify and quantify the proteins contained within a sample through very specific mass and charge of the molecules, and in this case, could identify and quantify the older "light" and newer "heavy" variation of each protein. Using this, with LC-MS and code-aided analysis, we can draw a degradation curve of the ratio of older "light" vs. newer "heavy" proteins within the iPSC derived neuron cells against time and calculate the half-life of proteins. Using the described techniques, we applied dSILAC LC-MS analysis to compare various commercial and homemade neuron culture for growing iPSC derived neuron culture to standardize and optimize the sample preparation workflow for future studies.

Primary Presenter

Jamison Shih

Status

Undergraduate

Authors

Jamison Shih

Ashley Frankenfield

Naomi Ni

Ling Hao

Research Mentor/ Department Chair

Ling Hao

RESEARCH SHOWCASE

CORCORAN,

ART HISTORY

Floating Through Decadence: A Comparative Look at Henri de Toulouse-Lautrec and Utagawa Kunisada

“Floating” Through Decadence will address the artistic response to societal decadence during the 19th century through the commercialized print works of Utagawa Kunisada (Japanese, 1786-1865) and Henri de Toulouse-Lautrec (French, 1864-1901). It first aims to define and compare concepts of the “floating world,” the namesake of Japanese ukiyo-e prints, in both early 19th-century Edo and fin-de-siecle Paris and establish the two artists’ connection to these societal sects. Encompassing both the Yoshiwara district of Edo Japan and Montmartre of Paris, France, the floating world established artistic niches for both Kunisada and Toulouse-Lautrec, informing their view and representation of the cities in which they inhabited.

While it has been suggested that Henri de Toulouse-Lautrec was inspired by the Japonisme movement in fin-de-siecle France, no comparative studies have been done to connect his work to a specific artist of the Japanese graphic arts from earlier times. A comparative look at Kunisada and Toulouse-Lautrec, focusing on their privileged, nationality-focused upbringings and work with commercialized printing processes, narrows the gap between the two artists and their relationships with “floating world” personalities. Both artists’ works reflect a direct comparison between a caricatured portrait of an actual individual and a real location, which helped propagate hope for their respective cultures facing cultural collapse and decadence. By depicting real people and places, they aimed to detract from the undercurrents of cynicism and decadence in their 19th-century worlds and promote an attainable, opulent place with existing individuals in their respective forms of commercialized prints.

Primary Presenter

Katherine Capristo

Status

Undergraduate

Author

Katherine Capristo

Research Mentor/ Department Chair

Bibiana Obler

RESEARCH SHOWCASE

EAST ASIAN LANGUAGES AND LITERATURES

Strands of Virtue: Exploring Gentry Laywomen's Hair Embroideries of Guanyin in Late Imperial Jiangnan

The research examines the relationship between virtue establishment and hair embroideries of Guanyin by gentry laywomen in late imperial Jiangnan. Embroidery has been a significant form of artistic expression for Chinese women, and pre-modern female devotees often embroidered Buddhist deities and sutras as a devotional practice. Some devotees displayed a higher level of religious commitment by stitching their hair into the Buddhist image. With Guanyin 觀音 (Skt. Avalokiteśvara), the bodhisattva of compassion, completely transformed into a female deity in the late imperial period, she became the most favored subject in hair embroideries of gentry laywomen in Jiangnan, which has been the center for Chan Buddhism and Guanyin worship. By examining literary texts and surviving hair embroideries, this research explores the significance of gentry women's choice of embroidery as an approach and hair as a medium to depict the image of Guanyin. The materiality of hair serves as the central theme and guiding framework throughout the paper's discourse. It argues that late imperial gentry laywomen utilized the practice of hair-embroidering Guanyin to materialize their simultaneous pursuit of multifaceted objectives in ideal gentry lay womanhood, which included a high level of religious commitment, genuine adherence to Confucian filial piety, and the demonstration of external and internal personal refinements. This research aims to contribute a comprehensive analysis of the material significance of women's hair in religious crafts and its impact on shaping ideal feminine traits in late imperial China.

Primary Presenter

Sophie Lam

Status

Graduate

Author

Sophie Lam

Research Mentor/ Department Chair

Jonathan Chaves

Xiaofei Kang

Liana Chen

RESEARCH SHOWCASE

EAST ASIAN LANGUAGES AND LITERATURES

China's Forgotten Simplification Scheme: A Cross-Disciplinary Analysis of the Failure of the Second Round of Simplified Chinese Characters

While many are aware of the two different sets of Chinese characters currently in use—the so-called simplified (简体字; *jiǎntǐzì*) and traditional (繁體字; *fántǐzì*) forms—significantly fewer are aware of the attempts to further simplify the writing system by mainland China in the late 1970s. These so-called “second round simplifications” or *erjianzi* (二简字) have been glossed over by many Sinologists as a poorly designed reform, yet few have investigated this proposal in rigorous detail. This presentation seeks to determine the various reasons and their significance in the failure of the *erjianzi* scheme, particularly through analysis in three major fields. The first is a historical and political argument regarding the formation of the writing reform committee, the internal strife within the Chinese Communist Party during the plan’s creation, and the hesitance towards large-scale reform both publicly and privately in a post-Mao China. The second is a linguistic and computational approach, using empirical methods to determine characteristics such as stroke counts across *erjianzi*, the distribution of simplification methods, and even sampling of contemporary materials at the time of the reform to better understand the impacts of the new script in practice. The last aspect will be a comparative analysis with the execution and implementation of *jiǎntǐzì* as opposed to *erjianzi*, including an evaluation of early digitization efforts of the Chinese script and its impact on the rejection of the second round simplification scheme. With both detail and breadth, viewers should leave with a newfound appreciation for the Chinese writing system as a whole, and a deeper understanding of an oft forgotten step in the development of the Chinese languages as they exist today.

Primary Presenter

Jake Messick

Status

Undergraduate

Author

Jake Messick

Research Mentor/ Department Chair

Hongyuan Dong

RESEARCH SHOWCASE

ECONOMICS

The Relationship between Entrance Fees and National Park Attendance

The National Park Service (NPS) administers 63 major parks that host hundreds of millions of American and foreign tourists every year. Despite its importance as a public entity, the NPS has not received sufficient funding to address its years-long, multi-billion-dollar maintenance backlog. Absent assistance from Congress, the NPS turned toward the one fiscal lever within its control: the park fee schedule. A 2017 attempt to raise entrance fees elicited such significant backlash from parkgoers that the proposal was withdrawn, yet the question of the efficacy of raising admission fees to meet growing fiscal obligations remains. The degree to which visitors will accept price increases, therefore, is of great importance to the NPS, since it could help determine whether price hikes are a viable means of increasing revenue given its budget constraints. This paper attempts to answer the question of what, if any, effect the cost of admission—as proxied by the vehicle entrance fee—has on the total number of visits to national parks. Entrance fee data from 30 parks, collected over 28 years from 1993 to 2021, was provided by the NPS and compiled into a panel, along with data on unemployment, real GDP per capita, and national gas prices. After applying a panel regression framework to the aforementioned sample, controlling for those variables just mentioned and park-level fixed effects, this study finds that a one percent increase in the vehicle entrance fee results in a statistically significant ($p < 0.05$) 0.084 percent decline in total visits. The relatively small size of this coefficient implies that visitors are fairly unresponsive to changes in the price of admission. In other words, the NPS could raise significant revenue to remedy its fiscal shortfall through fee increases, without fear of a massive decline in park attendance. More broadly, national parks are publicly-owned, and the relative responsiveness of the public to the change in price of park admission may have implications for other public entities that charge fees, but do not rely on them entirely for continued operation.

Primary Presenter

Truman Giles

Status

Undergraduate

Author

Truman Giles

Research Mentor/ Department Chair

Chao Wei

RESEARCH SHOWCASE

ECONOMICS

How Does Flooding Affect Food Security in Southern Nigeria?

Floods are one of the most common and recurring disasters in Nigeria—particularly during the rainy season starting from May until September. Over the last few decades, flooding in Nigeria have grown more destructive and unpredictable as the effects of climate change have advanced.

In the summer of 2012, immense heavy rainfall—compounded by the breakdown of dams and river overflow—brought about the worst floods the country has seen in more than 40 years. My research question examines how the 2012 floods may have the rates of impacted food security and economic shocks for northern and southern households. This paper builds on the literature assessing how floods affect food security in Nigeria which have limited to field survey and small regions within the country.

To assess the broader implications that these floods have on households, I conducted a diff-in-diff approach to examine how southern households compare to northern households after the 2012 floods regarding economic shocks and food security. I hypothesize that since the major flooding event in 2012, household food insecurity in southern Nigerian regions increased more over time than household food insecurity in Northern Nigerian states. Secondly, I hypothesize that southern Nigerian households experienced more economic shocks due to flooding over time than northern Nigerian households. My results indicated that southern households had higher rates of both food insecurity and economic shocks due to flooding following 2012. Nigeria must invest in water management infrastructure and flood mitigation programs to safeguard southern households from the acute socioeconomic implications that flooding poses.

Primary Presenter

Adewale Maye

Status

Graduate

Author

Adewale Maye

Research Mentor/ Department Chair

Christopher Campos

RESEARCH SHOWCASE

ECONOMICS

The Impact of the Colombian Narcotrafficking Industry on Colombian Peso Currency Demand

The shadow economy exists in virtually every economy. The shadow economy is generally described as any unregistered economic activities that contribute to the officially calculated Gross National Product and that would generally be taxable if they were reported to the tax authorities. In general, shadow economies are minimized in countries that are part of the Organization for Economic Cooperation and Development (OECD), where shadow economies are generally between 14% and 16% of the official GDP. This body of research focuses on the Colombian shadow economy and the impact of narcotrafficking on currency demand in Colombia, therefore it is key to note that indirect taxation and unemployment are the most significant factors driving the Colombian shadow economy.

To combat the narcotrafficking industry and the shadow economy, the Colombian government has worked to eradicate coca crops through two major methods: aerial eradication and manual eradication. Aerial eradication is the primary eradicating method and uses a glyphosate coca-killing aerator sprayed through low-flying aircraft to eradicate Colombian coca plants; however, it destroys any plant it touches, including non-coca crops. Additionally, there was a significant drop in the percentage of agriculture value added to the total Colombian GDP between 1999 and 2000 where the World Bank observed a drop of 13% to 8.3% of agriculture as a percentage of GDP in Colombia. This decline in the percentage of agricultural value added to the total Colombian GDP coincided with increased efforts of aerial spraying eradication of coca cultivation in Colombia, therefore demonstrating a possible connection between the agriculture percentage of GDP and air eradication of coca in that the aerial eradication method has caused more harm as it damages other crops and decreases total Colombian GDP.

The Colombian average growth rate of real GDP per capita is 1.11% between 1976 and 2002, and the shadow economy explains an average of .02 percentage points of this growth, and between 1991 and 2015, the shadow economy of Colombia contributed on average 33.31% to the total GDP. These findings demonstrate that the real GDP per capita of Colombia grew instead of shrinking due to illicit activity. The shadow economy can therefore help create new opportunities and support working families in Colombia, despite the generally negative rhetoric surrounding this form of employment.

Primary Presenter

Eva Schwartz

Status

Undergraduate

Author

Eva Schwartz

Research Mentor/ Department Chair

Stephen Smith

RESEARCH SHOWCASE

ECONOMICS

Lessons from Minneapolis: Mixed Zoning Regulation and Property Assessments

Zoning regulations, particularly single-family housing regulations, have been the subject of controversy in many American cities. These regulations restrict constructing multiple housing units to one parcel of land. Some argue that elimination of single-family zoning regulations will decrease property values, whereas urban planners argue that these regulations artificially increase land prices, displacing lower-income residents. Over the past several years, many major American cities have seen a dramatic increase in monthly rent prices. In response, the city of Minneapolis, Minnesota eliminated single-family zoning regulations entirely in 2020. This is the first major metropolitan area to ban single-family zoning. Using novel government property assessment panel data, I find that if a parcel of land designated as a single-family dwelling changed to a multi-family housing unit, the total value of the property assessment increases by .25 percentage points or a 700 dollar assessment value increase.

Primary Presenter

Connor Zielinski

Status

Undergraduate

Author

Connor Zielinski

Research Mentor/ Department Chair

Pao-Lin Tien

RESEARCH SHOWCASE

FILM STUDIES

Public heritage and cultural representations of the Troubles in Northern Ireland in Film and Television

The period of sectarian conflict and political violence in Northern Ireland from the late 1960s to the late 1990s, also known as “The Troubles,” is largely regarded as the breaking point in the relations between Catholics and Protestants in the area. Upon hundreds of years of conflict, difference, and colonization under British rule, “The Troubles” resulted in the deaths of 3,600 people and left at least 30,000 people injured (Hansson and Roulston 730). “The Troubles” constituted a complex and multifaceted conflict, which involved a range of social actors and had a significant impact on the lives of people in Northern Ireland and beyond. In “Working with the Cultural Heritage of Conflict for Peacebuilding: Lessons Learned from the Western Balkans,” researchers Stefanie Kappler and Johanna Mannergren Selimovic argue that engaging with cultural heritage is a fundamental component of peace processes. These authors note several different types of heritage, including digital heritage, which is increasingly important in our technological world (Kappler and Selimovic 13). One form of digital media in particular that has heightened the attention on violent conflict is cinematography, as the voices of filmmakers and the film narratives from conflict areas are increasingly being heard and supported in this multi-billion dollar industry. Lessons learned from violent conflict can serve as inspiration, as those who have been affected by conflicts attempt to come to terms with their own traumatic pasts and seek outlets through which they can raise understanding of the impacts and dynamics of violent conflicts among wide audiences (Smets 796). Furthermore, a certain “Troubles nostalgia” seems to exist even among people fortunate enough not to have lived through that baleful period (Coulter 433). Although public heritage and cultural representations of “The Troubles,” particularly those created by filmmakers, may be important to aiding peace processes, allowing affected individuals to create their own stories of the conflict, and preserving public heritage, they may be nonetheless to some extent out of step with contemporary society in Northern Ireland because of the persistence of divisive narratives and conflicting memories of this period. This paper examines two contemporary pieces of digital media related to “The Troubles,” namely the British teen sitcom “Derry Girls” (2018) and the semi-autobiographical feature film “Belfast,” (2021), explaining how the persistence of divisive narratives and conflicting memories of this period may make such representations in digital environments partial and thus somewhat out of step with contemporary society in Northern Ireland.

Primary Presenter

Daria Nastasia

Status

Undergraduate

Author

Daria Nastasia

Research Mentor/ Department Chair

Elisabeth Anker

RESEARCH SHOWCASE

GEOGRAPHY

Understanding the COVID-19 Pandemic Impacts on Women in Alaska through the Prism of a Wellness Concept

The Arctic has historically been vulnerable when met with emergency situations, and the COVID-19 pandemic is no exception. The region's geographic remoteness and limited access to resources elevate the importance of nuanced subnational and local regulations. In focusing on Alaska's gender-sensitive policy responses to the pandemic, this paper will examine the effectiveness of Alaska's legislation using the gendered lens, focusing on one of its most at-risk demographics: women. Under the pandemic, women are disproportionately affected in terms of unemployment, domestic violence, and increased burden of responsibilities, including child/elderly care and household tasks. In addition, women working in female-dominated spheres such as healthcare are subject to higher rates of COVID-19 contraction. In this context, the growing volume of literature demonstrates that a public health approach extending beyond physical healthcare is essential amid and beyond the pandemic.

Mainstreaming wellness as an integral part of government responses can be considered a good practice. Notably, this holistic approach has some similarities to the ideas of health and wellness among Alaskan Indigenous Peoples. The wellness model developed by the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA) consists of eight equally valued components—social, occupational, intellectual, emotional, physical, environmental, financial, and spiritual. Although this model was designed to encourage recovery amongst individuals dealing with substance use, it highlights the importance of a holistic approach to crisis response. The paper will therefore evaluate Alaska's gendered policy response to the COVID-19 pandemic through the prism of a wellness concept to better understand lapses in gender-responsive crisis-time decision-making in addressing SAMHSA's eight dimensions of wellness.

With the analysis of Alaska's policy compendiums, this paper's classification of policies in terms of their responsiveness to women's needs in the prism of the wellness concept will inform a holistic understanding of decision-making trends and policy-relevant highlights for Arctic regions' solutions to crises.

Primary Presenter

Laura Goodfield

Status

Undergraduate

Authors

Riya Bhushan

Alicia Glassman

Laura Goodfield

Anissa Ozbek

Sophie Rosenthal

Research Mentor/ Department Chair

Marya Rozanova-Smith

RESEARCH SHOWCASE

GEOGRAPHY

Climate Change Impacts Future Agricultural Productivity in Southern Brazil

Changing climatic conditions are significant determinants of future agriculture. As landscape conditions change, agricultural outputs will be influenced by emerging conditions which boost or limit productivity. This study focuses on agriculture in Rio Grande do Sul, the southernmost state of Brazil. As the top producer of rice and tobacco in the country and the top exporter of tobacco in the world, Rio Grande do Sul agriculture can be used as a proxy for livelihood success and economic productivity. The purpose of this study is to combine climate change data from 2 shared socioeconomic pathways to create relative agro-productivity estimates for key landmarks of 2020 (present), 2050 (near-future), and 2100 (far-future). The latest available CMIP6 climate data and geospatial techniques are used to provide suitability estimates for rice and tobacco growth in Rio Grande do Sul municipalities at these landmark intervals. Through this process, we can identify areas that are most suitable or unsuitable for rice and tobacco growth under moderate (SSP245) and extreme (SSP585) projected climate scenarios. Though the state is already a leader in sustainable food systems change, subsistence and agribusiness producers will need to continue to develop and adapt to oncoming environmental changes in order to provide food and job security. In further study, the results of this research may be used for quantifying agro-economic change. Additionally, this project functions as a reference for climate-assisted decision-making, concerning resource allocation and the implementation of sustainable agricultural technologies.

Primary Presenter

Emma Haggerty

Status

Undergraduate

Author

Emma Haggerty

Research Mentor/ Department Chair

Dmitry Streletskiy

RESEARCH SHOWCASE

GEOGRAPHY

Meaning of green and white public spaces for Arctic citizens

The Arctic is a very urbanized area. According to the Arctic Human Development Report, published in 2015, nearly two-thirds of the Arctic population live in cities. It means that there is a need in urban space for developing social cohesion and communication. Though the theme of urban socio-environmental interactions is highly developed in cities that are characterized by tropical and temperate climates, the lack of knowledge exists on how these interactions would be developed in harsh Arctic climatic conditions.

The aim of the research is to understand the meaning of open public spaces for Arctic citizens. As the Arctic warms four times faster than on average and Arctic cities experience increased warming due to urban heat island effect, one of the main research focuses is on climate change and how it affects public spaces usage. In this research open public spaces are defined as green (parks) and white (parks covered with snow). The material for analysis consists of qualitative data from social media, local newspapers and interviews with citizens. Research areas include Fairbanks (the US) and Nadym (Russia). At first, two kinds of representations of urban public spaces are gathered: personal and emotional one through social media, and "objective" and rational through local newspapers. Further, the gathered information is supplemented by interviews with local citizens. The research has a potential for sharing knowledge with local communities on public spaces as sources of urban resilience to climate change. Moreover, the research on this topic will contribute to theory on urban sustainability.

Primary Presenter

Diana Khaziakhmetova

Status

Graduate

Author

Diana Khaziakhmetova

Research Mentor/ Department Chair

Vera Kuklina

Robert Orttung

RESEARCH SHOWCASE

GEOGRAPHY

An Intersectional Analysis of Climate Change Migration in Hyderabad, India: Challenges and Alternatives

Telangana, a state within Southern India, is geographically and socioeconomically diverse, and suffers from an extremely fluctuating natural environment. Some areas face frequent droughts or depletion of groundwater resources, while other areas flood and receive higher rainfall, encouraging many to migrate. Although displacement due to climate change is on the rise, there is limited research available on this. Even within the limited existing literature, researchers analyze India on a macroscopic scale, which doesn't account for the diversities within the people and its states. Some scholars have shown how extreme immediate crises like droughts and monsoons significantly impact displacement; yet slow onset change is under-researched. This is especially true of migrants who belong to rural, vulnerable, and marginalized populations. With my research, I investigate: How is internal migration to Hyderabad impacted by variation in precipitation? What systemic factors impact these migrant experiences? What is the role of the Indian government in adapting to these effects? Through local semi-structured interviews with migrant activists and NGO workers in Hyderabad, I am able to collect information on migrant and grassroots perspectives on the slow-onset climate catastrophes. Moreover, analyzing India's climate change policy on the national and state level provides an understanding of the state's policy objectives, current mitigation interventions, and how important the state believes climate change is. Compiling this with the interviews, it is understood that there are minimal mitigation processes in place to handle this challenge. Additionally, there is a large gap between the policy level and implementation, creating an emphasis on community care. Recommendations highlight opportunities for the development of policy interventions and the need to explicitly address climate change, provide a process to streamline the integration of migrants, and considerations for policy makers in communicating with the grassroots level for adaptation strategies.

Primary Presenter

Arzina Lakhani

Status

Undergraduate

Research Mentor/ Department Chair

Alex Cromwell

Kavita Daiya

RESEARCH SHOWCASE

GEOGRAPHY

Frozen Commons: Snow, Ice, and Permafrost Change, Use, and Management in Interior Alaska

Climate change is affecting geographies all across the globe, but the Arctic region is experiencing some of the most severe impacts, often disproportionately impacting small populations in remote Indigenous communities. These communities rely on the environment for subsistence, which makes them particularly vulnerable to climate-induced changes. Nikolai and McGrath are two majority Upper Kuskokwim Athabascan villages in southwest Alaska experiencing significant warming over the last 80 years based on analysis of weather station observations and modeled climate reanalysis. The “Frozen Commons,” project aims to identify collectively managed ice, snow, and permafrost resources, and determine how these commons are threatened by climate and societal change. It is crucial to observe the environmental and climatic conditions to understand the types of changes these communities are undergoing, their use of these frozen resources, and to discuss future adaptation strategies. This presentation reviews the status of snow, ice, and permafrost surrounding the two communities of interest: Nikolai and McGrath, Alaska. Summaries of change from 1991-2020 are presented on regional snow coverage data, river ice thickness observations, and permafrost maps and ground temperature models. Change trends are presented in the context of general community use including safe snow and ice transit and building bearing capacity on permafrost. Initial findings reflect the adverse impacts of warming climate conditions on snow, ice, and permafrost commons. Discussion of these results is complemented and expanded based on community input and Indigenous methodologies.

Primary Presenter

Pauline Mnev

Status

Undergraduate

Authors

Kelsey Nyland

Vera Kuklina

Research Mentor/ Department Chair

Kelsey Nyland

Vera Kuklina

RESEARCH SHOWCASE

GEOGRAPHY

Mapping Urban Deprivation: Leveraging Open Geospatial Data and Machine Learning Techniques

Most low-and middle-income countries are experiencing the proliferation of deprived areas taking up urban spaces. These areas have inadequate supply of basic infrastructures, water, sanitation, and energy, and are prone to climate-related hazards. Current methods for mapping deprived areas rely on either physical (morphological features from earth observation data such as building density, Haphazard, organic orientation) or socioeconomic indicators such as population, crime, ethnicity, providing only a partial view. This study seeks to overcome these limitations by integrating both physical and social indicators through the use of open geospatial data and machine learning tools. To do this, the study first conceptualized deprived areas to allow inter/intra city comparison. Second, developed a consistent feature-creation method for integrating varying spatial and temporal resolutions. Third, carried out gradient boosting machine learning and assess their performance on unseen geographic regions, and finally, investigated important indicators and their influence on the model using Shapley Additive Explanations (SHAP). A model trained in Accra and tested in Nairobi achieved an F1 score of 71%. This demonstrates the potential of open geospatial and machine learning to predict deprived areas in unseen geographic areas with unique characteristics. The study provides a promising solution for accurately mapping deprived areas globally, supporting stakeholders to plan geotargeted interventions and monitor changes.

Primary Presenter

Maxwell Owusu

Status

Graduate

Authors

Maxwell Owusu

Ryan Engstrom

Research Mentor/ Department Chair

Ryan Engstrom

RESEARCH SHOWCASE

GEOGRAPHY

Gendered Policy Responses to the Covid-19 Pandemic: The Case of Alaska

The Arctic has historically faced tremendous challenges when met with emergency situations, and COVID-19 was no exception. Arctic geographic remoteness and limited access to necessities make the call for nuanced subnational and local regulations dire, especially regarding women, a group often placed at high risk during crisis.

Focusing on Alaska's gendered responses to the COVID-19 pandemic and its lapses, this paper contributes to the discourse on Arctic regions' localized government initiatives and good practices. With the pandemic's exacerbation of soft security issues in Alaska, applying a gender lens to tailor state legislation and create gender-responsive local initiatives is vital. Implementing this approach can be particularly crucial to improving access to health, social care systems, and public health infrastructure during crisis by accommodating the needs of female-dominated sectors of the economy.

With the analysis of Alaska's policy compendiums, this paper's classification of policies in terms of their responsiveness to women's needs will inform a holistic understanding of legislative trends and policy-relevant recommendations for Arctic regions' solutions to crises.

Primary Presenter

Anissa Ozbek

Status

Undergraduate

Author

Anissa Ozbek

Research Mentor/ Department Chair

Marya Rozanova-Smith

Nikolay Shiklomanov

RESEARCH SHOWCASE

GEOGRAPHY

Mapping Informal Road Networks Using Local and Indigenous Knowledge with Citizen Science Partners

Irkutsk Oblast (administrative region of the Russian Federation) has experienced intensive development by extraction industries over the last several decades. Hydrocarbon and timber industries dominate in this region and have significantly contributed to the rapid expansion of informal road networks. Informal roads encompass all roads not maintained, recognized, or mapped by governing bodies and include everything from hunting trails to paved industrial roads. Informal roads are important to the local and indigenous populations for subsistence activities and access between communities and markets. The goal of this study was to map informal road development in Irkutsk Oblast. Advising faculty conducted fieldwork and interviewed locals, indigenous Evenki people, and industry representatives in two study areas. A majority of roads were digitized during a mapathon event held in collaboration with GW's Humanitarian Mapping Society (HMS). A road identification key was developed with input from communities residing within the study areas in the Irkutsk region. Community engagement also helped with validation of roads mapped with HMS in ArcGIS Pro based on CORONA and DigitalGlobe satellite imagery from 1964-1965 and 2017-2020 respectively. The expansion of the road network was determined by comparing the line density for the two time spans using line density analysis. Results show that informal roads have significantly expanded over the last 50 years. A closer examination of interviews from five case studies illustrates the variety of new benefits and challenges of various types of informal roads for local and indigenous people practicing subsistence. All digitized roads and features from this project are publically available online through the OpenStreetMap (OSM) platform in an effort to share the data with those from the region and increase awareness of the rapid hydrocarbon and timber extraction development occurring in the Irkutsk taiga.

Primary Presenter

Stine O. Petersen

Status

Undergraduate

Authors

Kelsey Nyland

Vera Kuklina

Jacob Tafrate

Research Mentor/ Department Chair

Kelsey Nyland

RESEARCH SHOWCASE GEOGRAPHY

Arctic Greening and Permafrost-Vegetation Feedbacks Observed on Alaska's North Slope

The term “Arctic greening” describes a widely observed northward expansion of denser and taller vegetation communities. As a response to climate trends in one of the most rapidly warming regions of the planet, this shift in vegetational properties has profound implications for the frozen ground, or permafrost, that underlies vast portions of the terrestrial Arctic. Vegetation, like snow, insulates soil, keeping it cooler than air temperatures in summer months and warmer in winter months. The Circumpolar Active Layer Monitoring (CALM) program administered by GWU studies responses of near-surface permafrost to climate change. This poster presentation summarizes continuous air and soil-surface temperatures and active layer thickness (maximum annual thaw depth) from nine one-hectare study plots representative of vegetation types along the bioclimatic gradient of Alaska's North Slope over the period from 1995-2022. Utilizing temperature differences and N-factors, we describe air-to-ground temperature trends over the 27-year observation period. We observe departures in air and soil-surface temperatures indicative of Arctic greening in all studied landscapes coupled with little increase in active layer thickness. Preliminary results point toward two distinct reactions of the active layer to changes in (1) graminoid tundra (dominated by mosses, grasses, and sedges) and (2) shrub tundra (ranging in height from <5cm prostrate to >40cm low shrubs). An increase in thermal insulation provided by graminoid tundra produces a negative feedback in which active layer thickness remains relatively consistent from year to year as extensive summer thaw is insulated against. In shrub-dominant tundra, the trend of increasing insulation produces a positive feedback, encouraging permafrost thaw and thereby increasing active layer thickness. The results of this study contribute to a better understanding of ecological feedback mechanisms that impact permafrost, designated an Essential Climate Variable by the Global Climate Observing System. Improving our understanding of factors influencing permafrost change is critical to modeling, conservation, and adaptation efforts in rapidly warming Arctic environments.

Primary Presenter

Fox Pfund Pulliam

Status

Graduate

Authors

Fox Pfund Pulliam

Kelsey E. Nyland

Research Mentor/ Department Chair

Kelsey E. Nyland

Nikolay I. Shiklomanov

RESEARCH SHOWCASE GEOGRAPHY

Monitoring Permafrost Thaw Under Rapid Warming in Arctic Alaska

Permafrost – ground that remains below 0 °C for at least two consecutive years – underlays approximately 22% of the Earth’s surface in the Northern Hemisphere. Evidence suggests that warming air temperatures promote permafrost warming and thickening of the active-layer -- the uppermost soil horizon of permafrost, which thaws in the summer and refreezes in the winter. Changes in the thermal dynamics of the active layer have immediate implications for human settlements on permafrost, but further research is needed to adequately forecast and prepare for potential risks. The Circumpolar Active Layer Monitoring (CALM) program, funded by the U.S. National Science Foundation and administered by the GW Geography Department, consists of over 200 permafrost monitoring sites distributed across both hemispheres. The program examines the response of active-layer thickness to climate change.

This study assesses climate, active layer, vegetation, and microtopography observations from Utqiagvik, Alaska. Active layer measurements in 10 m² grid across a 2 km transect were started by the U.S. Army Corps of Engineers’ Cold Regions Research and Engineering Lab (CRREL) in 1962 and have been conducted by CALM since 1991. Over the past 60 years, air temperatures in Utqiagvik have significantly increased by 0.79 °C per decade. While observations indicate that permafrost in Utqiagvik is warming at depth, long-term active-layer thickness records do not show any significant reaction to the warming climate. Distinct positive correlations between active-layer thickness and mean annual air temperature are only evident at the CRREL transect over roughly decadal time intervals. A previous hypothesis suggests that near-surface components of the permafrost system instead react to disturbance in a Markovian-like manner. This hypothesis posits that over multi-decadal time scales, local factors such as latent heat, above-ground biomass, and soil moisture may “reset” the active layer to a new regime that is continued for several years.

Vegetation was resampled following CRREL methods from the early 1960s. In addition, a UAV was flown over the site to conduct microtopographic mapping. Testing the Markov hypothesis, we find that simple Markov frameworks do not fit the 60-year record of active-layer thickness trends at the CRREL transect. Further analysis should explore spatially dependent Markov models that consider microtopography and ground subsidence. Assessing the response of active-layer thickness to climate change at the CRREL transect has important implications for improving regional climate and other ecological models that incorporate permafrost thaw dynamics.

Primary Presenter

Rachel Saltzman

Status

Graduate

Authors

Rachel Saltzman

Kelsey E. Nyland

Research Mentor/ Department Chair

Kelsey E. Nyland

RESEARCH SHOWCASE

GEOGRAPHY

Measuring Urban Sustainability in Transition in Luleå, Sweden

Driven by amplified rates of climate warming and a variety of economic development initiatives, Arctic cities are undergoing significant environmental, social, and economic transformations. In the sporadically populated Arctic, these cities serve as crucial hubs for regional economic growth, cultural activities, and decision making. However, these urban centers are historically supported by extraction industries, rendering them susceptible to boom and bust cycles, environmental change, and colonial legacies. This development struggle is typified by the green transition currently underway in Luleå, Sweden, where new Arctic industries, such as green steel, data centers, wind farms, and battery factories, are establishing operations. Understanding the influence of these developments on the city, and the surrounding region, is crucial information for long-term sustainability planning. The International Organization for Standardization specifies 46 core and 54 supporting indicators organized into 19 indicator themes, termed the ISO 37120 framework, as an effective way to gauge the sustainability of a city. As part of a larger NSF-funded project titled, "Measuring Urban Sustainability in Transition," or MUST, this presentation summarizes a statistical treatment of 20 years (2000-2020) of ISO indicators for Luleå. Luleå sustainability was characterized using a partial least squares structural equation model (PLS-SEM) to explore interactions between indicator themes: health, water, education, energy, and finance. Developing the PLS-SEM model allowed us to (1) define key indicators driving beneficial sustainability outcomes, (2) predict outcomes between 5-year intervals, (3) analyze how individual indicators predict overall outcomes. Initial results offer insights which plan to be shared with the mayor of Luleå along with sustainability commissioners, and indigenous groups serving on the MUST project advisory board. Interviews and project meeting discussions will be used to validate the initial PLS-SEM sustainability model developed for Luleå.

Primary Presenter

Jacob Tafrate

Status

Graduate

Authors

Jacob Tafrate

Kelsey E. Nyland

Robert W. Orttung

Research Mentor/ Department Chair

Kelsey E. Nyland

RESEARCH SHOWCASE

HISTORY

First in War, First in Peace, First in the Memory of His Countrymen: The Impact of George Washington's Memory During Times of Major Conflict in the United States

The memory of George Washington has pervaded the minds of Americans since the early years of the Republic. As the man who led the country to victory and union and set precedents of government still followed to this day, Americans have reason to remember Washington and look back on his memory. During times of conflict in the country, leaders and civilians were quick to reference Washington and mold his memory to fit their cause. They looked to his actions to justify their own and the precedents he left behind guided action and inaction throughout war times.

This project offers an analysis of the methods and ways that political and military leaders as well as civilians used George Washington's memory throughout the War of 1812, the Civil War, World War I, and World War II. Using documents from Washington's lifetime, with primary focus on his Farewell Address, in tandem with political speeches and acts, contemporary symbols, and civilian accounts, this project argues that the malleability of Washington's memory is crucial for the justification of action or inaction during these times of major conflict in the United States. The use of George Washington's image as a military recruiting tool in the War of 1812, his place on the Confederate seal and money, the direct references in Abraham Lincoln's inauguration addresses, Woodrow Wilson's use of Washington's precedent on treaty negotiations, and Washington's image at America First rallies during World War II encapsulate the malleable nature of Washington's memory. Without Washington's memory to justify the steps taken in each conflict, civilians and leaders may have found themselves caught defending unpopular causes with no justification. Since Washington's memory remained paramount to many Americans, the use and shaping of his memory had the ability to create unity even during times of division and conflict.

Primary Presenter

Alex Brandis

Status

Undergraduate

Author

Alex Brandis

Research Mentor/ Department Chair

Denver Brunsmann

RESEARCH SHOWCASE

MATHEMATICS

Computing Fox Coloring Group and Alexander-Burau-Fox Module for Braided Knots

In the highly specialized discipline of mathematical knot theory, the central question: *are these knots the same?* has occupied hundreds of mathematicians across centuries. In our current research, we restrict our attention to answering this question with knots whose shapes can be described as a specific type of braiding on three strands. These knots, sometimes called Turkhead links, have the braid presentation $\sigma_1 \sigma_2^{-1})^n$, where n describes the number of times one performs the given braiding moves. We find that we can compute a specific type of knot invariant, called the Reduced Fox Coloring Group, by encoding the relationships between the understrands and overstrands in our knot diagram to algebraic operations. In doing so, we find that we can present the matrix of relations for the Reduced Fox Coloring group in terms of the well-known Fibonacci numbers.

We generalize this result to compute the Alexander-Burau-Fox matrix A_n over the ring $\mathbb{Z}[t^{\pm 1}]$ and show that $A_n = -g_n \begin{bmatrix} g_{n+1} + t^{-1}g_{n-1} & -t^{-1}g_{n-1} \\ -tg_{n+1} & g_{n+1} + tg_{n-1} \end{bmatrix}$ where $g_n = S_{k-1}$ for $n=2k$ and $g_n = S_{k-1} + S_k$ for $n=2k+1$ and S_k is the Chebyshev polynomial of the second kind.

Primary Presenter

Anthony Christiana

Status

Graduate

Authors

Anthony Christiana

Huizheng (Ali) Guo

Józef H. Przytycki

Research Mentor/ Department Chair

Józef H. Przytycki

RESEARCH SHOWCASE

MATHEMATICS

The Generalized Kauffman-Harary Conjecture is True

For a reduced alternating diagram of a knot with a prime determinant, the Kauffman-Harary conjecture states that every non-trivial Fox p -coloring of the knot assigns different colors to its arcs. In this paper, we prove a generalization of the conjecture stated nineteen years ago by Asaeda, Przytycki, and Sikora: for every pair of distinct arcs in the reduced alternating diagram of a prime link with determinant δ , there exists a Fox δ -coloring that distinguishes them.

Primary Presenter

Huizheng Guo

Status

Graduate

Authors

Rhea Palak Bakshi

Huizheng Guo

Gabriel Montoya-Vega

Sujoy Mukherjee

Józef H. Przytycki

Research Mentor/ Department Chair

Józef H. Przytycki

RESEARCH SHOWCASE MATHEMATICS

Discovering the Hyper-Rook: Enumerating Boundary Format Hypermatrices

A classic combinatorics problem is the following: given an $n \times n$ chess board, how many ways are there to place n rooks so no two are attacking each other? We can generalize this problem by restricting where rooks can be placed. The solutions to these types of problems provide insight into what rook placements are possible and at what frequency they occur. Another interesting problem is how many invertible matrices are there over a finite field? At first these two questions may seem unrelated; how could a simple question about placing pieces on a chess board be related to such an abstract mathematical concept as matrices? It turns out the number of each object is closely related, and counting the frequency of one object will tell you how many of the other object exists.

While this problem has been solved for quite some time, we will show that there exists a natural generalization into three dimensions, where instead of the familiar rook placements we have hyper-rook placements. Similarly, instead of matrices we now have hypermatrices. These objects are quite more complex than regular matrices and we will highlight some of the difficulties working with them. Overall, we will give a first look at counting these objects, showing there exists a maximal number of restrictions we can make, as well as a conjecture on what hyper-rook placements look like. We will also give an outline of the proof counting these objects and show why this number is so nice.

Primary Presenter

Brandon Koprowski

Status

Undergraduate

Author

Brandon Koprowski

Research Mentor/ Department Chair

Joel B. Lewis

RESEARCH SHOWCASE

MATHEMATICS

Nonlocal effect on a 1D generalized Ohta-Kawasaki model

We propose a nonlocal Ohta-Kawasaki model to study the nonlocal effect on the pattern formation of some binary systems with general long-range interactions. While the nonlocal Ohta-Kawasaki model displays similar bubble patterns as the standard Ohta-Kawasaki model, by performing Fourier analysis, we find that the optimal number of bubbles for the nonlocal model may have an upper bound no matter how large the repulsive strength is. The existence of such an upper bound is characterized by the eigenvalues of the nonlocal kernels. Additionally we explore the conditions under which the nonlocal horizon parameter may promote or demote the bubble splitting, and apply the analysis framework to several case studies for various nonlocal operators.

Primary Presenter

Wangbo Luo

Status

Graduate

Authors

Wangbo Luo

Yanxiang Zhao

Research Mentor/ Department Chair

Yanxiang Zhao

RESEARCH SHOWCASE

MEDIA AND PUBLIC AFFAIRS

COVID's Impact on the Communications Practices and Goals of Religiously Affiliated Student Organizations

This study looks at how religiously affiliated student organizations (RASOs) at private, non-religiously affiliated universities in Washington, D.C. navigated their organizations through the COVID pandemic. More specifically, this study looks at how they used social media and other communications channels to communicate with their members and maintain a sense of community as COVID pushed life online. This study seeks to examine if RASOs have a preferred social media platform for communications purposes, what content is published on their utilized communications platforms, and if a specific platform works best. Through content analyses of RASOs' social media accounts and newsletter emails from August 2019-December 2022, this study looks at the extent to which these RASOs focused on specific post content and the degree to which they turned to a greater focus on well-being and mental health-centric posts. The findings from this study yield potential insights as to how certain RASOs use social media, how social media is used in general in times of crisis, and best the general social media practices for other types of collegiate organizations.

Primary Presenter

Caleb Auerbach

Status

Undergraduate

Author

Caleb Auerbach

Research Mentor/ Department Chair

Kimberly Gross

RESEARCH SHOWCASE

MEDIA AND PUBLIC AFFAIRS

Understanding Democratic Presidential Rhetoric Through American Mythology

Scholars have long argued that America has a “civic religion” – distinct from specific sectarian religion that individuals typically identify with – which draws on the founding documents, symbols, rituals, and national myths to form a set of shared values designed to unite the nation and craft a unique American identity. Since America’s founding, its presidents have invoked the civil religion in their speeches – employing religious language referencing common American civic myths and themes. In recent years, however, polling has shown that Americans, especially those who identify as Democrats, describe themselves as less religious and more skeptical of common American myths (Hartig, 2021; Smith, 2021; Thorsett and Kiley, 2017). As these ideas begin to resonate less with Democrats, it is possible that Democratic presidents might change their use of civil religion and myth to reflect these shifting views. To investigate this assumption, and to better understand the role of civic religion in presidential rhetoric, this paper employs a rhetorical analysis of the speeches of Presidents Clinton, Obama and Biden to investigate whether certain themes of civic religion remain as key features in presidential rhetoric. Specifically, this project analyzes presidential speeches for the presence of four “myths.” The first is the myth of “American religion,” which in civil religion discourse is the use of religious terms like ‘holy,’ ‘sacred’ or even the invocation of a non-denominational ‘god’ watching over America. The second, is the myth of the “American hero,” which is exemplified in historical figures like Abraham Lincoln and groups like ‘the troops,’ ‘firefighters’ or ‘police officers.’ The third myth is “American exceptionalism,” which includes any mention of America’s exceptionality or uniqueness because of its founding principles or morals. Finally, the fourth myth is the “American dream,” or the idea that anyone in America – regardless of their background – can reach the top of America’s social and economic hierarchy through hard work and opportunity. Preliminary data show an increase in references to American religion and a marked decrease in references to American heroes, American exceptionalism and the American dream. These findings imply that changing opinions have caused a reduction in presidential references to all myths except American religion. This finding provides evidence of resilience in the myth of American civil religion as it remains relevant in the speeches of the last three Democratic presidents despite changing Democratic beliefs.

Primary Presenter

John Fine

Status

Undergraduate

Author

John Fine

Research Mentor/ Department Chair

Kimberly Gross

RESEARCH SHOWCASE MEDIA AND PUBLIC AFFAIRS

The Evolution of the Benefit Concert as a Means of Musician Advocacy

This paper explores celebrity advocacy efforts undertaken by musicians to understand how they capitalize on their fame to further the causes they believe in. The guiding research question of this work is “How have the advocacy tactics of musicians evolved over the last 60 years?” and my hypothesis is that “this brand of advocacy has not only increased its scope (reaching more individuals), but its impact as a result of technological change and a shift toward post-democracy.” Specifically, this paper centers on the development of benefit concerts as an application of this advocacy to determine how the strategies and tactics around these events have grown and how their impact and scope have changed. The concerts examined are The Concert For Bangladesh (1971), Live Aid (1985), Live 8 (2005), and Farm Aid (1985-present). Methods of analyzing these events consist of a content analysis of contemporary and retrospective coverage from three outlets (*Rolling Stone*, *The New York Times*, and *The Guardian*) in addition to examining the available footage and audio of the concerts, accounts/interviews from the organizing artists, and basic event statistics (such as viewership totals, attendance, funds raised, and record sales). This work focuses on the organizational capacity of musicians rather than their artistic output to try and determine how tactically successful these events are at achieving their desired ends. Since this brand of advocacy has only grown in the last half-century, looking into its effects is crucial to understanding its role in society and these concerts' influence on modern advocacy work.

Primary Presenter

James P. Infortuna

Status

Undergraduate

Author

James P. Infortuna

Research Mentor/ Department Chair

Kimberly Gross

RESEARCH SHOWCASE

MEDIA AND PUBLIC AFFAIRS

Social Media and Humanitarian Agenda Setting: The CNN-Effect Revisited

Why does the United States become militarily involved in certain humanitarian crisis? What role does the media play, specifically social media, in influencing such decision making? This study investigates these questions by expanding on the traditional CNN-effect hypothesis in a modern context. Drawing on a research framework generated by previous scholars, this study looks specifically at whether, and how, social media exerted influence on traditional media coverage of the Syrian Civil War and humanitarian conflict (2011-2019). Given the conflicting findings of past CNN-effect scholars, this study solely addresses the relationship between social media and traditional media and forgoes an attempt to demonstrate whether media directly influences policy outcomes. By looking specifically at several demonstrated instances of chemical weapons attacks (CWAs) in Syria over eight years of conflict, this study controls for both the legality of intervention and whether intervention occurred, and specifically addresses the role of potential social media influence. By using a statistical analysis framework in conjunction with visual analysis on Tweets pertaining to a specific timeframe, this study seeks to establish a correlation between Twitter mentions and traditional print media mentions of given CWAs. By coding for specific keywords, our preliminary findings contribute to the CNN-Effect hypothesis and suggest a potential Granger-causation relationship between social media mentions of a given CWA and traditional print media coverage. I expect to find that that while social media may not directly exert influence on policymakers, Tweets on a given subject typically precede traditional media coverage – such findings may thus contribute to overarching research of media influence and demonstrate the contemporary influence of social media sites such as Twitter.

Primary Presenter

Chanler Miller

Status

Undergraduate

Author

Chanler Miller

Research Mentor/ Department Chair

Kimberly Gross

RESEARCH SHOWCASE ORGANIZATIONAL SCIENCES AND COMMUNICATION

IMPROVING PUBLIC ACCEPTANCE OF NUCLEAR ENERGY IN THE UNITED STATES

Around the world, nuclear power represents a polarizing topic in conversations about energy production. Proponents argue that it is less financially and environmentally costly than ongoing use of non-renewable sources, while opponents focus on perceived risks of nuclear waste and accidents. Nuclear energy has regained public interest as a method of maintaining reliable power supply during the transition towards renewable energy. However, lack of public support for expanding nuclear power stands in the way of its widespread adoption.

In the US, support and opposition are split along party lines, with 60% of Republicans in favor compared to only 39% of Democrats. Democrats' generally low levels of support for nuclear power represents an interesting paradox, as nuclear can help reach environmental goals. In addition to being generally supportive of enhancing alternatives to carbon-intensive sources of energy, 79% of them are confident in scientists to come up with accurate conclusions.

In this study, Olivia Bullock (PhD) and I propose to examine three factors that we believe influence partisan perceptions of nuclear power: a consensus message, the message source, and the chosen wording. Consensus messaging is a message design strategy that communicates to lay audiences the degree of agreement among a given group about a particular topic. There is reason to believe that Democrats' greater trust in science will make them more subject to reconsider their opinion on nuclear energy if exposed to a high degree of consensus amongst scientists. We also believe that exposing conservatives to a high degree of Republican support will further improve overall support. Lastly, we suspect that the way nuclear energy is referred to as nuclear or atomic has the potential to affect perceptions.

To test these ideas, we are collecting data from 1,200 American participants in a survey, in which they will be exposed to different messages about support for nuclear energy and answer a list of questions. We expect this survey to improve support for nuclear energy among participants.

Our study aims at providing business and policymakers with usable knowledge to better design communication strategy about nuclear energy. In my home country, France, 80% of electricity supply is provided by nuclear power plants, something that actively contributes to making France a sustainable energy leader worldwide.

Primary Presenter

Josephine Courtel

Status

Undergraduate

Authors

Olivia Bullock

Josephine Courtel

Research Mentor/ Department Chair

Meina Liu

Olivia Bullock

RESEARCH SHOWCASE

ORGANIZATIONAL SCIENCES AND COMMUNICATION

Influences on Book-Buying and Subsequent Effects: A Look into the Process

According to the Pew Research Center (<https://www.pewresearch.org>, 2012), 26% of those who had read a book in the prior 12 months did so for the purpose of learning. However, 15% responded that they read to escape their daily lives, and 12% read to relax. In a 2022 survey (<https://www.pewresearch.org>, 2022), 75% of US adults were found to have read a book in the past 12 months, a statistic that has remained consistent since 2011. Since consumers are reading books, not only to learn but to also improve their mental state, we wondered what decisions might be involved in buying a book that consumers read for pleasure. Through quantitative survey items, this research is designed to explore the mediating impact of the perceived quality of books on the relationship between a set of predictor variables (peer recommendations, online reviews, literary critiques, and celebrity endorsements) and a set of outcome variables (likelihood of purchase, satisfaction with a purchase, and interpretation of a book). 100 participants were surveyed, and the resulting data were analyzed using multiple regression analyses. All effects and implications of the data will be discussed; future research could explore other possible drivers of book-buying behavior and the unique impact of specific celebrity endorsements on book interpretation. In an increasingly high-tech society, the platforms used to read and discuss books are expanding, and this research may bring us one step closer to identifying how people find that *perfect* book.

Primary Presenter

Julia DeLuca

Status

Undergraduate

Author

Julia DeLuca

Research Mentor/ Department Chair

Nils Olsen

RESEARCH SHOWCASE

ORGANIZATIONAL SCIENCES AND COMMUNICATION

The Impact of Workplace Age Discrimination: A Comparison between Chinese and American Employees

Building upon the conservation of resources theory (Hobfoll, 2001) and the cross-cultural literature, the present study examined the effects of workplace age discrimination on employee career satisfaction and affective commitment across Chinese and American employees. China and America, which are representative of a Far Eastern culture and a Western culture respectively, differ from each other in cultural dimensions of individualism and power distance (Hofstede et al., 2010). As such, when experiencing age discrimination at work, Chinese employees may be very reactive to such unexpected discrimination and thus their career satisfaction and affective commitment may be lowered to a greater extent.

To test our hypotheses, we conducted a quantitative survey in a group of Chinese (N=463) and American (N=521) employees. Age discrimination, career satisfaction, and affective commitment were measured using a 6-item scale developed by Furunes and Mykletun (2010), a 5-item scale by Spurk et al. (2015), and a 3-item scale by Meyer and Allen (1997), respectively. Participants completed surveys in their native languages, English and Chinese, with the Chinese surveys translated using the standard translation and back translation procedure (Brislin, 1985). Results of multiple regression analyses found that the country by age discrimination interaction effects were significant for both career satisfaction and affective commitment. Specifically, the negative relationships of age discrimination with employee career satisfaction and affective commitment were stronger (vs. weaker) for Chinese (vs. American) employees

Primary Presenter

Zhangziyue Huang

Co-Presenter(s)

Hanadi Haidarzada

Status

Undergraduate

Authors

Zhangziyue Huang

Hanadi Hidarzada

Chelsea Riccardi

Yisheng Peng

Yiwen Chen

Jiayi Wang

Research Mentor/ Department Chair

Yisheng Peng

RESEARCH SHOWCASE
**ORGANIZATIONAL
SCIENCES AND
COMMUNICATION**

**Identifying Pitfalls in Contemporary
International Conflict Mediation**

Rates of international conflict mediation have stagnated since 2005 (Lundgren, 2020). Understanding the decline of mediation is essential to the revival of the practice. This paper analyzes “pitfalls” that have occurred in mediations of the past, and the extent to which those pitfalls may also be responsible for the decreasing utilization of mediation since 2005. This study analyzes mediations that have occurred both during and prior to the period of declining international mediation and inspects pitfalls that may be contributing to the failure of those mediations during both time periods. I identify three pitfalls to successful mediation: mediator bias, “conflict ripeness,” and bad faith agreements. I then establish lasting peace and number of mediation rounds as outcome variables, in order to gauge the success level of mediation. I conduct an archival analysis, divided evenly between 1991-2004, the height of international mediation, and 2005-2020, the decline of international mediation. I hypothesize that certain pitfalls have increased in prevalence over time, lengthening conflicts and shortening lasting peace. Time is included as a mediating variable, as I hypothesize that time has influenced the occurrence of the mediation pitfalls. This paper addresses findings and implications of the research, including limitations.

**Primary
Presenter**

Hailey Messina

Status

Undergraduate

Author

Hailey Messina

**Research
Mentor/
Department
Chair**

Nils Olsen

RESEARCH SHOWCASE
**ORGANIZATIONAL
SCIENCES AND
COMMUNICATION**

**Neurodiversity in the Corporate Workplace: Its
Competitive Advantage**

While there is important and powerful research surrounding diversity, equity, and inclusion, neurodiversity has only been recently recognized as a form of diversity within workplace diversity practices (Marshall, 2022). This recent focus on neurodiversity has risen, in part, because employee perceptions about how companies embrace and fulfill DEI initiatives are key indicators of job satisfaction and employee retention (D'Allaird, 2016). Given that roughly 15-20% of the U.S population is neurodivergent and that neurodivergent individuals possess unique skillsets that are considered valuable to companies, neurodiversity is an important avenue to explore for companies who want to remain competitive (Austin & Pisano, 2017). Inspired by HBR's piece, "Neurodiversity as a Competitive Advantage" by Robert D. Austin and Gary P. Pisano, this study is designed to explore barriers for neurodiversity within the workplace as well as the value of implementing workplace-processes that are inclusive to neurodiverse individuals and drive organizational success. This study utilizes semi-structured interviews to capture unique perspectives and experiences from internal stakeholders who are knowledgeable of and have experience within corporate-based DEI initiatives, hiring practices, employee support systems, and management styles. Through the use of thematic analysis, this study provides a foundational understanding of how neurodiversity contributes to an organization's success and competitive advantage.

**Primary
Presenter**

Kathleen Santarelli

Status

Undergraduate

Author

Kathleen Santarelli

**Research
Mentor/
Department
Chair**

Nils Olsen

RESEARCH SHOWCASE

PHILOSOPHY

The Institutional Compass in Guadalajara: A Look at the Tequila Industry

The Institutional Compass is a new tool for evaluating institutions developed by Dr. Michele Friend based on social, environmental, and economic data. It is helpful for developing policy direction for institutions based on where they are now and where they wish to be. A general compass has been constructed for the Santiago River Basin, in Mexico, and this research will contribute to the larger project by examining the compass of the regional tequila industry. This industry was chosen because Dr. Friend and I will be able to connect with an industrialist and develop a relationship to attain information to construct the compass while studying abroad in the region (3/10-3/19). Based on the results, we propose actions the industrialist can take that will measurably contribute to the restoration of the Santiago River basin.

Primary Presenter

Emily Philbrook

Status

Undergraduate

Authors

Emily Philbrook

Michele Friend

Research Mentor/ Department Chair

Michele Friend

RESEARCH SHOWCASE

PHILOSOPHY

In Pursuit of the Good Life: How the Focus on Stillness of Mind Within Buddhism and Epicureanism Help Approximate this Goal

Throughout history, humans strove to make sense of their existence and to improve their conditions. The concept of “the good life” or what attributes correspond to reaching such a life, are heavily contested. However, over the course of time, various philosophical traditions have identified a common element on this path: the stillness of mind. My thesis demonstrates, notwithstanding the notable differences in period, culture, and their respective metaphysical approaches, how Epicureanism and early Buddhism arrive at strikingly similar insights on approximating the “good life.” These two schools of thought, Epicureanism and Buddhism, emphasize mental stillness, which culminates in a state of Ataraxia for the former and Nibbāna for the latter. In both traditions, these states are considered the end goal of their paths.

While I explore the significant parallels in the philosophies, I am not trying to establish that there is a direct Buddhist influence on Epicureanism and vice versa, but rather raise the question of why stillness of mind is so integral to a conception of the good life in different philosophical traditions dominating both the East and West. Further, my aim is to show how these ancient practices can serve as our most vital defense against the perpetuated forms of suffering in the modern age. Toward this, I draw on the Samatha Vipassanā tradition and elements of Epicurus’s differentiation of desire to argue that mental stillness practices need to be used to offset barriers to greater insight and concentration.

The project inquires into the background conditions and specific articulations that each philosophy identifies in approximating a stillness of the mind and highlights how this approach remains fundamental despite differences. This project hopes to open a broader discussion of our continued striving towards an ideal state and further utilizes the identified similarities of these two philosophies to better understand how we can live a good life regardless of the advancing pressures of the attention economy and capitalism.

Primary Presenter

Bairavi Sundaram

Status

Undergraduate

Author

Bairavi Sundaram

Research Mentor/ Department Chair

Eyal Aviv

RESEARCH SHOWCASE

PHYSICS

Creating safer indoor meeting spaces in GW's Corcoran Hall by tracking aerosol flows

As the COVID-19 pandemic has continued, in person meetings and classes have once again become the norm at the George Washington University. To reduce the risk of contracting COVID-19 during these gatherings, we must work to make sure the meeting spaces on campus are safe. One of the main ways COVID-19 spreads is through aerosol particles that hang in the air. Our lab uses arrays of Particle Matter 2.5 (PM 2.5) sensors to track the concentration of aerosols over time in spaces both on and off campus. This study focuses on measurements taken in rooms 404A and B103 of Corcoran Hall. We use these measurements to create videos showing the movement of aerosols and give suggestions on how spaces can be improved, decreasing the risk of contracting COVID-19 for students and faculty.

Primary Presenter

Grace Bradley

Status

Undergraduate

Author

Grace Bradley

Research Mentor/ Department Chair

Mark Reeves

RESEARCH SHOWCASE

PHYSICS

Testing Nuclear Theory by Analysis of Subatomic π^- Particle Production

High-energy interactions between particles are beyond explanation by classical physics, requiring relativistic quantum mechanics, the physics of fast-moving, small particles, for full explanations of their outcomes. While classical, macroscopic mechanics would allow for simple, easy-to-solve explanations of these interactions, relativistic quantum mechanics as a physical basis has far more complex foundations and, as such, is far less simple to explain with theory. The Regge theory of scattering, a system for explaining relativistic quantum mechanical interactions between particles, has matched results for various experiments at various energy levels, but not all interactions, at all energy ranges, have been confirmed as valid cases for use of Regge theory. One particular reaction and energy range of interest is the production of a subatomic particle called the π^- meson off of a neutron by hitting the neutron with a very high-energy photon. The meson is produced at an angle relative to the wave oscillations of the light beam, and the distribution of these angles is able to be predicted by Regge theory. I will present my progress on the comparison between experimental data and theory, as well as analysis of expected uncertainties.

Primary Presenter

Logan Earnest

Status

Undergraduate

Author

Logan Earnest

Research Mentor/ Department Chair

Axel Schmidt

RESEARCH SHOWCASE

PHYSICS

Analyzing the Energy Resolution of a Lead-Tungstate Calorimeter for a Proposed Two-Photon Exchange Experiment

Protons are one of the most fundamental building blocks of the world around us, being present in every bit of matter in our day to day lives. However, probing the proton is not as simple as just looking at it. Despite relative prior consensus, recent developments in experimental techniques have cast doubt on something as seemingly straightforward as how the proton's positive charge is distributed. A discrepancy in measurements of the proton's electromagnetic form-factors, characterized by which of two experimental procedures is used, may be caused by a higher order correction term called two-photon exchange (TPE). Recent attempts to measure TPE extracted the TPE contribution to elastic electron-proton scattering by measuring the positron-proton scattering to electron-proton scattering cross section ratio, but have lacked the ability to measure TPE where the discrepancy is large. The TPEX Experiment, proposed to run at DESY, aims to measure TPE through this same cross section ratio at kinematics where the discrepancy is clear. TPEX will measure scattered electrons and positrons with a set of ten arrays of lead glass calorimeters. These calorimeters will need sufficient resolution to distinguish elastic scattering events from pion electro-production, a prominent background process. I will present the results from the TPEX Spring 2022 Test Beam to extract the energy resolution of a prototype TPEX calorimeter array as a function of temperature, in addition to a Monte Carlo simulation of the pion-production background. These studies demonstrate the feasibility of TPEX utilizing lead-tungstate crystals, whether or not future test-beam experiments are required, and conveys the status of TPEX's contribution to this ongoing scientific debate.

Primary Presenter

G.N. Grauvogel

Status

Undergraduate

Author

G.N. Grauvogel

Research Mentor/ Department Chair

Axel Schmidt

RESEARCH SHOWCASE

PHYSICS

Non-Diffractive Polarization Properties of Vectorial Vortices

The spin and orbital angular momenta of vector waves produce nontrivial three-dimensional (3D) polarization degrees of freedom due to the presence of longitudinal field components. Here, we consider optical and acoustic vortices, both of which possess a phase singularity along the propagation axis. We demonstrate analytically that the transverse dimensions of polarization parameters are fixed and behave independent of a vortex beam's divergence. Furthermore, we verify our findings with numerical models created via the finite-element method in COMSOL Multiphysics. Our results (i) open new avenues for the study of polarization features in 3D wave structures and (ii) offer potential applications for wireless communication technologies, optical and acoustic tweezers, metrology, and super-resolution imaging.

Primary Presenter

Andrew Kille

Status

Undergraduate

Authors

Andrew Kille

Andrei Afanasev

Research Mentor/ Department Chair

Andrei Afanasev

RESEARCH SHOWCASE

PHYSICS

The Upcoming BurstCube Gamma-Ray CubeSat

BurstCube is a 30 by 20 by 10-centimeter CubeSat designed to detect gamma-ray transients including gamma-ray bursts and gravitational waves. It will be launched to and later deployed from the International Space Station in late 2022 or early 2023 for at least a one-year mission. It will point primarily zenith (away from earth) to get a wide field of view of as many events as possible. It will observe the explosions of dying stars (called gamma-ray bursts) as part of a network of other satellites with Fermi and Swift. I am using these multi-instrument observations to build a large statistical sample of gamma-ray events as part of the planning for this instrument. These samples will be cross matched to tell us what types of events the instrument will detect, so that we can plan the downloads and observations. In this poster, you will note some of the planning that has gone into BurstCube, and what will eventually become of the final project—what powers gamma-ray bursts?

Primary Presenter

Pi Nuesle

Status

Graduate

Authors

The BurstCube Team

Research Mentor/ Department Chair

Judith Racusin

Chryssa Kouveliotou

RESEARCH SHOWCASE

PHYSICS

Measurements and Simulations of $(e,e'n)/(e,e'p)$ in ${}^3\text{He}$ for High and Low Momentum Nucleons in CLAS6

Recent data mining analyses from the CLAS experiment at Jefferson Lab have enabled detection of neutrons from the hard break up of Short-Range Correlated (SRC) pairs, leading to the observation that protons are disproportionately represented in high momentum states in neutron-rich nuclei. Here we seek to determine whether neutrons speed up in proton-rich nuclei by studying the proton-rich nucleus ${}^3\text{He}$ using data from the CLAS e2a experiment. This talk will present preliminary measurements of ${}^3\text{He}(e,e'n)/{}^3\text{He}(e,e'p)$ in the mean field and in the short-range correlated pair regime, indicating an enhancement of neutrons in high momentum states. We also present theoretical predictions of ${}^3\text{He}(e,e'n)/{}^3\text{He}(e,e'p)$ in the Plane-Wave Impulse Approximation using 3-body spectral functions.

Primary Presenter

Erin Marshall Seroka

Status

Graduate

Authors

Erin Marshall Seroka

Holly Szumila-Vance

Axel Schmidt

Research Mentor/ Department Chair

Axel Schmidt

RESEARCH SHOWCASE PHYSICS

Illustrating Quantum Mechanical Time Evolution

We present the time dependence of simple quantum mechanical systems in the form of short interactive animations. The Schrödinger equation is the principal equation of quantum mechanics that dictates the time-dependence of wave functions. This equation is hard to visualize, therefore the purpose of this project is to distribute the animations and their derivations for students to help them understand quantum mechanics. Our research centers around using Mathematica to model the Schrödinger equation. We are dissecting this equation into its time and position components. We are also discussing the preliminary math in order to bridge the understanding gap of the concepts behind the equation such as complex numbers, partial derivatives, expectation values, operators, and initial conditions.

Primary Presenter

Ilana Stern

Co-Presenters

Caroline Hill

Amy Georgescu

Ilana Stern

Status

Undergraduate

Authors

Caroline Hill

Amy Georgescu

Ilana Stern

Research Mentor/ Department Chair

Michael Doering

RESEARCH SHOWCASE

PHYSICS

Implementing mitigation measures in residential spaces to decrease the spread of COVID-19

The advent of the COVID-19 pandemic has revealed inadequacies in protecting public health. Implementation of new practices to protect others when an individual is infected is essential and necessary for any widespread, airborne disease. The knowledge of clear mitigation measures is important when the infected person lives with one or more individuals and shares some communal space(s). In this study, we focus on dormitory rooms at The George Washington University as the communal spaces, but the measures can be applied to a variety of living situations. We induce aerosol particles into the air and use mapping techniques, with Particulate Matter (PM) 2.5 sensor arrays, to show where high concentrations of particles are in a particular room or area. Through repeated testing of possible mitigation measures, we will show if concentration levels decrease because of implementing the new measures. We will be able to advise the public of ways to help protect themselves from possible infection, or at least lower the likelihood of infection.

Primary Presenter

Emily Sullivan

Status

Undergraduate

Author

Emily Sullivan

Research Mentor/ Department Chair

Mark Reeves

RESEARCH SHOWCASE

POLITICAL SCIENCE

A Little Goes a Long Way: How Small-Dollar Contributions Empower Candidates of Color and Propel Congressional Representation in a Post-*Citizens United* Digital Era

Data from the U.S. Census Bureau indicates an increasing racial and ethnic minority population in the United States reaching majority status within the next two decades. While minority representation in Congress has improved in recent elections, people of color remain significantly underrepresented. Meanwhile, post-*Citizens United* campaign finance data suggests unprecedented amounts of money, particularly big money, spent in elections. Obstacles to improving representation in the modern campaign finance system include disparities in fundraising resources, which perpetuate the racial fundraising gap. This paper seeks to analyze the relationship between donor size and minority representation. Through a regression analysis on campaign finance data in every congressional election from 2008-2022, this paper finds a statistically significant and positive relationship between small-dollar contributions and proportions of non-white representation in Congress. Moreover, this paper attempts to trace the evolution of online fundraising as a catalyst in the growth of small-dollar contributions for both major parties and candidates of color. As big money and modern technology continue to rise in scope and influence, small-dollar contributions – especially through digital fundraising – and public financing systems assist the diversifying electorate with choosing leaders from their communities.

Primary Presenter

Hope Ledford

Status

Undergraduate

Author

Hope Ledford

Research Mentor/ Department Chair

Nicole Bartels

RESEARCH SHOWCASE

POLITICAL SCIENCE

The Impact of the Fear of Election Irregularities on Media Behavior

How does political anxiety affect individuals' news consumption habits? The experiment explored in this research seeks to understand the impact of fear on behaviors surrounding political media. Past research suggests that an uptick in the fear of election irregularities took place during 2016 and 2020 presidential election cycles. Using a survey experiment, this research seeks to examine whether an increase in the fear of election irregularities effects the consumption and perceptions of reliability of further media material about election irregularities. Activating the fear of election irregularities proved to increase the consumption of election-related news. It also altered participant's perceptions of the reliability of election-irregularity-related news stories, with those who had the fear activated assigning higher reliability scores to a general set of stories and, most interestingly, semi-unreliable stories. These findings provide evidence that, in the case of election irregularities, an increase in fear of a political phenomenon has a significant impact on future media behavior surrounding that phenomenon.

Primary Presenter

Julia Lynn

Status

Undergraduate

Research Mentor/ Department Chair

Eric Grynaviski

RESEARCH SHOWCASE

POLITICAL SCIENCE

Critical Race Theory and Anxiety in Media: Examining Sensationalized Language in Media and the Effects on Education

In a 2022 country divided by party politics, the question of whether individuals are reacting to inflammatory media statements, or to the substance of policy or ideas becomes prevalent. The controversial topic of “critical race theory” and the role this subject could play in classrooms has become a concern for politicians across the country. What is the opinion of critical race theory in race-based classes on college campuses and are people supportive of this becoming a general education requirement for college students? Should critical race theory be taught at the elementary school level? Do participants feel skeptical about critical race theory due to the sensationalized media language and attention, or is it denounced for its actual practice? This paper uses a survey experiment. The survey was conducted online, yielded 111 respondents, and used 2 treatment groups as well as a control group to gain insight to these questions.

Primary Presenter

Emma Mitchell

Status

Undergraduate

Author

Emma Mitchell

Research Mentor/ Department Chair

Eric Grynaviski

RESEARCH SHOWCASE

POLITICAL SCIENCE

The Critique of Patriarchy Is Central to Modern Thought

At a conference held by the United Nations in Beijing in 1995, Hillary Rodham Clinton who was at the time the First Lady of the United States as the wife of President Bill Clinton made the seminal statement “human rights are women’s rights and women’s rights are human rights.” A National Geographic report published 25 years later argued that Hillary Rodham Clinton’s speech at a UN conference “propelled this idea into the mainstream after centuries of society sidelining gender equality” (Blakemore).

While Clinton’s speech at the UN event in Beijing in 1995 and the ensuing “Beijing Declaration and Platform for Action” issued by UN Women affirmed the desiderates of gender equity and equality for the contemporary society, the assertion of women’s rights as human rights was actually not new and has increasingly been viewed by scholars as having constituted a major trend across modern political thought. As Melissa Butler argued in an article published in *The American Political Science Review* in 1978, the need to include considerations on the rights of women among the key issues of political philosophy became evident “not with Marx or Engels, nor with John Stuart Mill, but with still earlier liberal attacks on the political theory of patriarchy” such as those crafted by Thomas Hobbes and John Locke (Butler 135). Moreover, as Laura Brace stated in an article published in *The Journal of Political Philosophy* in 2000, early feminist writings such as those of Mary Wollstonecraft further integrated reflections on women’s rights with political thought by making a plea for the replacement of a “patriarchal and narrow view of self-ownership” with a “more relational view of power and self-sovereignty” (Brace 433). As Brace noted, Jean-Jacques Rousseau had described “a fraudulent social contract based on force and slavery and its replacement by a positive social contract based on consent and designed to protect liberty,” on which Mary Wollstonecraft modeled the description of “a very similar negative sexual contract and its replacement by a more positive one based on reciprocal duties” (Brace 433-434).

While some academic voices continue to dispute the idea that the critique of patriarchy is central to modern political theorizing, this idea has gained traction in political philosophy debates. Grounded in considerations on Locke, Wollstonecraft, and recent examinations of their works, this paper explores arguments both against and pro considering the critique of patriarchy as being central to modern political thought, concluding that discussions of women’s societal oppression and the possibility of gender equality have indeed shaped and changed such thought.

Primary Presenter

Daria Nastasia

Status

Undergraduate

Author

Daria Nastasia

Research Mentor/ Department Chair

Eric Lawrence

RESEARCH SHOWCASE PSYCHOLOGICAL AND BRAIN SCIENCES

Are autistic teens better at predicting preferences of autistic peers?

Learning about others is a crucial prerequisite for successful social interactions. Typically developing (TD) adults rely on feedback and prior knowledge about similar people to learn about someone new. Consistent with the hypo-prior account (Brock, 2012), Autistic adolescents rely on their own preferences to learn about TD peers (Rosenblau et al. 2021), potentially because autistic individuals do not integrate information from social feedback during learning. Alternatively, autistic individuals could apply social knowledge of autistic people when learning instead. To test this, TD adults (N = 94) and autistic adolescents (N = 101) rated two TD adolescents' preferences for 60 items and received trial-by-trial feedback. Separate samples of TD adults (N = 97) and autistic adolescents (N = 119) completed the same task for two autistic adolescents. We manipulated how similar learning profiles were to the average adolescent in both diagnostic groups where one profile was similar to the average preference profile (a TD person similar to the mean TD profile, i.e. mean profile) and the other was maximally dissimilar (odd profile). Learning was quantified by change in prediction errors (PEs) i.e., the difference between participants' ratings and feedback. Lower PEs reflect higher task accuracy. Average population preferences were based on self-preference ratings from TD adults (N=307) and autistic adolescents (N=285). We expected TD adults to have developed representations of average TD population preferences as reflected in lower PEs when learning about the mean TD profile vs. odd TD profile. Autistic adolescents would have lower PEs when learning about autistic profiles, yet still use their self-preferences during learning. As predicted, PEs were smallest when TD participants learned about the TD mean profile, higher for the TD odd profile, highest and indiscriminate for the autistic mean and odd profiles. Contrary to our predictions, autistic adolescents' PEs were lower for the TD vs. ASD profiles. However, the autistic adolescents did not show a significant difference in PE magnitude for mean vs. odd profiles. Both groups reduced PEs over time for the autistic profiles. As predicted, the autistic adolescents' self and mean preference correlated with their ratings. However, both the autistic adolescents' self and mean preferences were decorrelated with TD mean preference ratings. In sum, autistic adolescents are more accurate at predicting the preferences of TD adolescents. However, by relying on their self and mean preferences, the autistic adolescents did not show a difference in accuracy between the mean and odd TD profiles.

Primary Presenter

Shannon Cahalan

Status

Graduate

Authors

Sophia Block

Ann Clawson

Koen Frolichs

Christoph Korn

Gabriela Rosenblau

Research Mentor/ Department Chair

Gabriela Rosenblau

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Changes in COVID-related stress, living situations, and social support after return to in-person learning

Previous studies have found that COVID-related stress has negative impacts on well-being in college students (Li et al., 2020). But family support has been shown to improve pandemic-related depressive symptoms (Mariani et al., 2020). A potential mechanism of improved wellbeing, and decreased stress, due to family presence is social support, which is shown to protect against the negative effects of the pandemic (Padmanabhanunni et al., 2023). The current study examined factors associated with change in pandemic-related stress during the Fall 2021 semester. We hypothesized that social support and living with family would be associated with decreased COVID stress during the transition back to campus.

Participants (N = 148) were GWU undergraduate students (83% female, 59% White, *M age* = 19) who completed an online survey at the beginning (T1) and end (T2) of the fall 2021 semester. Pandemic stress (PS) was assessed using the Perceived Stress Scale (PSS; Cohen, 1994); higher scores indicated greater COVID-19 stress. A PS change score was created by subtracting T2 from T1. Social support from family, friends, and significant others was assessed using the Multidimensional Scale of Perceived Social Support (MSPSS). Participants reported their living situations at T1 (8.8% lived with family, 13.5% lived alone, and 77.7% lived with 'other'). Living arrangement was coded dichotomously as 0 = not living with family, and 1 = living with family.

A paired sample t-test found a significant decrease in PSS scores from T1 to T2 [$t(146) = -3.675, p < .001$]. An independent samples t-test found that students living with their families had a significantly larger decrease in PSS scores ($M = -5.25, SD = 6.25$) compared with participants who did not ($M = -1.57, SD = 6.10$), [$t(145) = 2.00, p = .047$]. A linear regression found that living with family significantly predicted lower T2 PS ($\beta = -4.33, p = .04$), but social support did not.

The results suggest that living with family was a protective factor in reducing PS during the transition back to in person learning, but social support was not. A limitation of this study is that the MSPSS is a global measure of social support, while living with family only examines the impact of one source of support. Other limitations are that the sample was majority female and White. Additional analyses should be conducted to investigate this association in a more representative sample and with other potential sources of social support.

Primary Presenters

Emily Dame

Sabrina Sigel

Status

Undergraduate

Authors

Sabrina Sigel*

Emily Dame*

Maya N. Cook

Vicky Ho

Christina Gee

Research Mentor/ Department Chair

Christina Gee

* Co-equal first authors

RESEARCH SHOWCASE PSYCHOLOGICAL AND BRAIN SCIENCES

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

The Relationship Between COVID-19 Anxiety and Support for Mask Mandates

The use of face masks became popular during the COVID-19 pandemic, with research suggesting that mask usage is associated with a reduction in COVID-19 transmission and decreased anxiety. College campuses are densely populated and are therefore a prime location for the spread of COVID-19. The present study aimed to observe the relationship between COVID-19 anxiety among The George Washington University (GWU) students and their support of university instated mask mandates. As a result of the continually changing experience of students and the necessary health precautions that need to be taken to combat the COVID-19 pandemic, the relationship between these two aspects must be explored. Participants in this study (N = 79) completed a survey in October 2022 measuring their COVID-19 anxiety and their support of the GWU mask mandate in different GWU locations. A correlational analysis showed that there was a moderate association between students' COVID-19 anxiety and their support of mask mandates, $r(77) = .43$, $p < .001$. This study may help GWU's administration understand student motivation for supporting and possibly following public health policies. Additionally, this finding contributes to literature on how emotions impact opinions on health behaviors.

Primary Presenters

Tyv Faggioni-Balcazar

Sabrina Sigel

Status

Undergraduate

Authors

Tyv Faggioni-Balcazar

Sabrina Sigel

Research Mentor/ Department Chair

Peg Baratt

Reem AIRabiah

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Beyond the Keypress: Utilizing a Novel Response Time Measurement to Assess the Relationship between Conscientiousness, Fatigue, and Visual Search Performance

Visual search, the process of looking for targets among distractors, is a complex cognitive process that underlies several critical professions (e.g., aviation security, radiology). Given the severe consequences of inadequate search in many real-world professions, it is important to assess negative factors impacting performance and then explore ways to ameliorate them. One clear example of a potential detriment to search performance is the impact of fatigue, where those who are fatigued have been shown to be slower and/or less accurate during search. It is important to assess factors that may protect against fatigue decrements, given that fatigue is difficult to eliminate in many search professions (regardless of how many breaks an organization provides to the workforce, some employees will arrive to work tired). In our previously published work (Grady et al., 2022), we demonstrated that conscientiousness—the ability to be goal-directed, plan, and delay gratification—significantly moderates the negative impacts of fatigue on search. Specifically, conscientious individuals did not show a significant drop in search accuracy when fatigued, but less conscientious participants had significantly poorer performance when reporting that they were fatigued. Intriguingly, the study did not find response time effects, even though the previous literature on speed-accuracy tradeoffs suggests that there may be such effects. That said, this lack of response time effects aligns with other current work in our lab that suggests that simple, standard response time measures are too blunt, and there may be orthogonal sub-components that relate to separable issues (e.g., motor initiation time vs. decision time). Specifically, Kramer et al., (2021) broke down response time into distinct components: time to *touch*, and time to *swipe*; time to touch was associated with motor response time and time to swipe was associated with cognitive performance. To further assess the nature of conscientiousness and its moderating capabilities in the relationship between fatigue and visual search performance, the current study used this more nuanced separation of response time metrics. In this presentation, I will discuss how using separable measures of motor responses and cognitive responses can provide insight into how conscientiousness and fatigue impact visual search performance.

Primary Presenter

Justin Grady

Status

Undergraduate

Authors

Justin Grady

Patrick Cox

Emma Siritzky

Samoni Nag

Research Mentor/ Department Chair

Stephen Mitroff

RESEARCH SHOWCASE PSYCHOLOGICAL AND BRAIN SCIENCES

The Moderating Effect of Neighborhood Perceptions on the Association Between Community Violence and Conduct Problems

Numerous studies have found consistent evidence affirming the positive association between adolescents' exposure to community violence and conduct problems (e.g., McCabe et al., 2005). Conduct disorder symptoms are predictive of adult conduct and risk taking, as well as mental and physical health risks (Herrenkohl et al., 2010). Given these harmful ramifications of youth's community violence exposure, it is important to identify protective factors to inform interventions for youth exposed to this stressor. To date, research examining factors that protect against community violence has focused almost exclusively within the family domain (Evans et al., 2023). To address this gap, the current study examined whether protective factors in the neighborhood domain, neighborhood safety and cohesion, moderated the association between community violence exposure and conduct symptoms. Participants were 488 urban, primarily Black adolescents who reported their community violence exposure (witnessing and victimization) and neighborhood perceptions (safety and cohesion). Symptoms of conduct disorders were assessed in 10th and 11th grade. Hierarchical linear regression analyses were conducted to examine the interaction between community violence exposure and neighborhood perceptions on conduct symptoms, while controlling for gender and conduct symptoms exhibited in 10th grade. Analyses revealed a significant interaction between community violence victimization and neighborhood safety ($B = 0.18, t = 1.47, p < 0.05$), such that at low levels of neighborhood safety, there was no association between victimization and conduct issues ($B = -0.05, t = -0.32, p = 0.75$), whereas at high levels of neighborhood safety there was a significant positive association between victimization and conduct problems ($B = 0.39, t = 2.59, p = 0.01$). These findings suggest that those who are victimized in an area perceived to be safer may be more reactive to community violence by exhibiting conduct problems, while those who reside in an area perceived to be less safe may be less reactive to victimization due to their routine exposure to community violence. Although neighborhood safety was not a protective factor as expected, exploring other aspects of youth's communities, such as neighborhood resources, may aid in the development of economical and sustainable interventions that foster positive community characteristics which could indirectly reduce the prevalence of conduct problems among adolescents by attenuating the effects of community violence exposure (Woods-Jaeger et al., 2019). Implications for intervention will be discussed.

Primary Presenter

Kate Hafemeister

Status

Undergraduate

Authors

Kate Hafemeister

Andrew Gepty

Nick Lalongo

Sharon Lambert

Research Mentor/ Department Chair

Sharon Lambert

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Associations between financial well-being and co-parental conflict during the COVID-19 pandemic

Isolation during the COVID-19 pandemic increased financial obstacles for parents such as changes in families' income and unemployment levels. During the pandemic, parents reported increased stress which interfered with parenting ability 60% of the time. The objective of the study was to determine how financial well-being impacted co-parental conflict related to COVID-19-related stressors. We hypothesized that lower financial well-being would be associated with higher co-parental conflict.

Participants were (N=389; 51% Black/African American, 37% White) parents with children ages 5-17 and an average monthly income of \$14,360. Participants who identified a co-parent (86% child's biological parent, 40% cohabiting with the child) completed online surveys during October 2021. Participants completed measures of COVID-related co-parenting conflict and financial well-being, with higher scores indicating greater conflict and greater financial well-being, respectively.

A linear regression was conducted using SPSS to test the association of financial well-being predicting co-parenting conflict while controlling for co-parents living with the child and the number of individuals living in the household. Contrary to our hypothesis and existing literature, higher financial wellbeing was associated with greater co-parenting conflict (B=.967; p=005). One explanation could be that higher financial status enabled families to discuss more lifestyle options to cope with COVID restrictions, which may have resulted in more co-parental conflict. Another explanation is that those with more financial stress may have more extended family social support, which resulted in lower levels of coparenting conflict related to COVID stressors. Future studies should examine social support as a protective factor in adjustment to pandemic-related stress.

Primary Presenter

Andrea Jara

Co-Presenter

Stephen Dillon-Streisel

Status

Undergraduate

Authors

Andrea Jara

Stephen Dillon-Streisel

Vicky Ho

Maya Cook

Christina Gee

Research Mentor/ Department Chair

Christina Gee

RESEARCH SHOWCASE PSYCHOLOGICAL AND BRAIN SCIENCES

Gender Discrimination, Alcohol Use, and Eating Behavior Among College Women

College women often experience discrimination based on their gender, with estimates that about 20% of women in higher education experience some form of gender discrimination (Steel Fisher et al., 2019). Furthermore, studies have shown that 10-20% of college women engage in disordered eating (Child Mind Institute, 2022), and 32% engage in binge drinking (Schulenberg et al., 2020). Given the prevalence of these issues, it is important for research to understand how gender discrimination, alcohol use, and eating behaviors may be related.

Data were collected from an 11-day daily diary study which examined the relationship between gender discrimination, eating behaviors, and alcohol use among college women. The present analysis includes data from this study's baseline survey and follow-up survey administered 11 days later. The baseline survey assessed past experiences of gender discrimination, whereas the follow-up survey measured eating behaviors and alcohol use over the previous 10 days. Participants were 181 college students (63% White; 175 female, 6 non-binary) aged 18-23 years old ($M = 19.45$, $SD = 1.21$).

Past-year experiences of gender discrimination significantly predicted alcohol and disordered eating outcomes over a 10-day period. Baseline gender discrimination predicted drinking frequency ($b = 1.66$, $p = .006$), drinking quantity ($b = 0.66$, $p < .001$), the number of days the participant felt buzzed ($b = 0.31$, $p = .013$), and the number of days the participant felt drunk ($b = 0.31$, $p < .001$). Among eating outcomes, baseline gender discrimination predicted binge eating ($b = 0.41$, $p < .001$), unhealthy eating ($b = -0.13$, $p = .009$), and restrictive eating ($b = 0.364$, $p = .007$). Additionally, there was a significant interaction between gender discrimination and self-reported *tendency to eat in response to stress*: among participants who reported high levels of eating in response to stress, gender discrimination significantly predicted *binge* eating ($b = .2871$, $p = .02$), while the same effect was not observed in participants with low levels of eating in response to stress ($p = .21$). However, this moderation effect did not emerge for *restrictive* eating ($p = .13$). These results demonstrate that gender discrimination can negatively impact the health behaviors of college women, especially women who have a tendency to eat in response to stress. Given these findings, universities must acknowledge and work to prevent the negative health implications associated with gender discrimination amongst college women, perhaps through gender-specific interventions addressing the stresses of sexism amongst this population.

Primary Presenters

Katrina N. King

Prudence O. Lindbergh

Status

Undergraduate

Authors

Katrina N. King

Prudence O. Lindbergh

Stacy M. Post

Michelle L. Stock

Research Mentor/ Department Chair

Michelle L. Stock

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Impacts of Racial Exclusion on Psychological Needs, Affect, and Antisociality among Middle-Aged Black Adults

The Needs-Threat Model highlights the adverse effects social exclusion can have on psychological outcomes (Williams & Nida, 2011). A prominent example of this is racial exclusion (Sue et al., 2008; Wesselmann & Williams, 2017). Black Americans experiencing racial exclusion (versus inclusion) are more likely to report higher negative affect, and reduced psychological needs and perceived self-control (Peterson et al., 2020; Stock et al., 2018; Williams, 2018). Additionally, rejection or exclusion experiences can evoke hurt feelings and increased willingness to exhibit aggression towards the rejector(s) (e.g., antisociality; Buckley et al., 2004). However, previous studies have focused on identifying such impacts primarily among young adult and White populations. With no experimental research investigating how racial exclusion experienced by middle-aged Black adults impacts psychological outcomes, this study aimed to fill this gap.

The present study examined racial exclusion (vs. inclusion), using Cyberball, on participants' psychological needs, negative affect, and antisociality. Participants were 95 Black Americans (82.1% Female) aged 40-60 years ($M = 49.21$, $SD = 6.28$) recruited from ResearchMatch. After pre-screening, participants signed up for a Zoom session with a research assistant, where they consented and were sent a link to the online questionnaire. Participants were randomly assigned to be included or excluded, and were subsequently surveyed on their psychological needs, affect, and antisociality. After study completion, participants were paid a \$15-20 e-gift card. To test how racial exclusion impacted these variables, ANCOVAs were run in SPSS, controlling for age and gender.

Participants who were excluded reported significantly lower psychological needs: belonging ($M_{exc} = 1.95$, $M_{inc} = 3.10$; $p < .001$), meaningful existence ($M_{exc} = 2.28$, $M_{inc} = 3.26$; $p < .001$), control ($M_{exc} = 1.63$, $M_{inc} = 2.59$; $p < .001$), and self-esteem ($M_{exc} = 2.04$, $M_{inc} = 2.55$; $p = .001$). Excluded participants were also significantly higher in negative affect ($M_{exc} = 2.16$, $M_{inc} = 1.80$; $p = .027$) and antisociality ($M_{exc} = 2.86$, $M_{inc} = 2.38$; $p = .004$). This study is the first to show how the negative effects of racial exclusion in middle-aged adults are similar to those found in studies with younger samples. Given these findings, our goal is to examine protective mechanisms (including racial identity and social support) that might reduce the associations between exclusion, affect, and threatened psychological needs for this population. Additional research is needed to understand and reduce the negative effects of exclusion on adult populations, especially those who might experience more exclusion.

Primary Presenter

Prudence O. Lindbergh

Status

Undergraduate

Authors

Prudence O. Lindbergh

Mary C. Jobe

Katarina E. AuBuchon

Sophie Blitsman

Megan A. Lang

Michelle L. Stock

Research Mentor/ Department Chair

Michelle L. Stock

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Structural features that underlie perceived anti-queer stigma: A conjoint analysis.

Background: Among queer persons—i.e., sexual and/or gender minorities—lifetime rates of discrimination are staggering, including experienced threats (57%), slurs (57%), microaggressions (53%), sexual harassment (51%), and violence (51%; Casey et al., 2019).

Discrimination, however, must be couched within larger sociopolitical environments. While the majority of research on queer discrimination focuses on person-to-person mistreatment (i.e., individual level), there is a concerning neglect of wider societal factors, institutional policies, and cultural norms (i.e., structural level; Hatzenbuehler, 2017). As a novel methodological approach to assessing and quantifying structural stigma, we employ conjoint analysis to assess perceived discrimination risk in local physical environments. In this way, we identify how specific environmental features (e.g., location type, familiarity, distance from home, time of day, presence of a peer/romantic partner) influence queer persons' perceptions of safety.

Methods: Two queer samples provided self-report data via Amazon's MTurk ($n = 455$) and Prolific ($n = 799$). Participants completed measures of their demographics, mental health symptoms, and past discrimination experiences.

Results: Data indicate that queer perceptions of discrimination risk are primarily determined by the location (33-45% influence) and a person's companions (28-37% influence). Queer folks appear especially wary of discrimination when with their romantic partner. Later times-of-day, increased distance from home, and decreased familiarity also denote discrimination risk. With age, queer persons increasingly value location and decreasingly value familiarity. Masculinity contributes to an increased emphasis on location whereas femininity contributes to an increased emphasis on one's companions.

Discussion: The present study responds to calls for research on the structural determinants of well-being in queer populations. By linking perceived discrimination risk with local community environments, we provide the necessary foundation for individual- and community-level intervention. In light of these findings, we consider strategies to promote local queer safety and integration.

Primary Presenter

Paddy Loftus

Status

Graduate

Authors

Paddy Loftus

Fallon R. Goodman

Research Mentor/ Department Chair

Fallon R. Goodman

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

The Relationship Between Gender Discrimination, Disordered Eating, and Stress Among College Women

Up to 20% of women report having experienced discrimination in higher education settings, which may include hostile and benevolent forms of discrimination. Studies have also found that structural sexism and the social construction of gender and gender roles influence disordered eating among women. Given that 10-20% of college women engage in disordered eating or have problematic attitudes toward eating, it is important to examine how gender discrimination may affect eating patterns among college women, a population at-risk to disordered eating. The current study examined gender discrimination and disordered eating behaviors among female college students who tend to eat in response to stress. In this survey study (N = 374) controlling for perceived stress in the past 14 days and BMI, results determined that experiences of gender discrimination significantly predicted binge eating and disordered eating among students with a tendency to eat in response to stress. Restrictive eating was not associated with gender discrimination among students with these tendencies. This study emphasizes the harmful eating behaviors that college women may engage in when they experience stressful events tied to discrimination based on a relatively fixed trait (e.g., gender). Future research should investigate the motivations behind binge and disordered eating after experiencing gender discrimination and research should examine ways to reduce the negative impacts of gender discrimination to promote healthy eating habits among college students.

Primary Presenter

Margaret Lyons

Status

Undergraduate

Authors

Stacy Post

Michelle L. Stock

Research Mentor/ Department Chair

Michelle L. Stock

RESEARCH SHOWCASE

PSYCHOLOGICAL AND

BRAIN SCIENCES

Children's Level of Death Anxiety and Their Experiences with Death

In 1988 Dennis E. Schell, Ph.D. completed his dissertation entitled "Predictors of Death Anxiety in Children (DASC)." The study included the development of a death anxiety scale for children, which was the only item in the study that was published, and an investigation into what might predict whether children respond anxiously to death and dying. The current study involved a complete review and refinement of the original data using a modern version of SPSS and extending the questions implied in the study.

The first hypothesis, a replication of previous research, was: children who experience the death of a pet will show less death anxiety compared to children who do not as measured by the DASC and children's reaction time (RT) to a word response task involving 3 death words and 10 neutral words. The second hypothesis, original to this study, was: children who experience the death of a human (e.g., family member or neighbor) will show less death anxiety than children who do not as measured by the DASC and RT. The third hypothesis, original to this study was: children who experience the death of a pet and the death of a human will show less death anxiety than children who have not experienced either as measured by the DASC and RT.

The results show that on both measures (DASC and RT) children who experience the death of a pet and the combined death of a pet and death of a human showed lower levels of death anxiety than children who did not, which confirmed the first two hypotheses. The third hypothesis was partially confirmed: the DASC showed less anxiety for children who experienced the death of a human, but the RT did not.

One explanation for the results reflects Harter's (1978) effectance motivation, which suggests when children are successful in mastering a task (confronting death), they will be less anxious.

Primary Presenter

Julia Marczevska

Status

Undergraduate

Author

Julia Marczevska

Research Mentor/ Department Chair

Dennis E. Schell

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

How Do Adolescents Sustain Cooperation with Peers Versus Highly Adaptive Computer Partners?

Sustaining cooperation is an important prosocial skill that becomes more sophisticated throughout development. Cooperation depends on whether we perceive others as trustworthy (e.g., having similar goals), and showing similar reciprocation tendencies. It remains unclear how humans decide to sustain cooperation with another human partner and whether this may differ when cooperating with a similarly adaptive non-human partner. To address this, we investigate how adolescents differ in sustaining cooperation with humans versus computer partners because adolescence is a period of increased social orientation. We hypothesized that adolescents show higher levels of sustained cooperation when believing that they played with a human partner. Adolescents (N=35; mean age=11y (SD = 2.6 y), mean IQ=117 (SD=12)) played an age-appropriate version of the iterative trust game. They were given five coins and could keep them or share one to five coins with a partner, the trustee. If they shared with the trustee, the amount was multiplied by four and the trustee could share back half of these coins or keep them for themselves. Adolescents played 20 rounds; the number of rounds was unknown to them. Adolescents played four different games with an adaptive computer partner. In two of these games, they were told to play with a human partner (social condition) and in the other two, they were told to play with a computer (computer condition). Thirty-two adolescents were invited in pairs. Pairs were matched for sex, age, and IQ, and did not know their partners prior to the experiment. Pairs played a real interactive game with each other in addition to the four games described above. A preliminary analysis found that adolescents shared more when thinking they played with a human compared to a computer. Additionally, adolescents used a tit-for-tat economic strategy throughout the task and shared less in later compared to earlier trials. They also used the tit-for-tat strategy more in later compared to earlier trials. We find that adolescents are more generous in the social condition; demonstrating a higher tendency to sustain cooperation with a human despite the computer partner being equally adaptive. As a next step, we will analyze the real interaction condition and compare it to the social and computer conditions. We will also test whether various learning models explain the data better than simple strategies. With this we aim to reveal the cognitive strategies of adolescents during (uniquely) social interaction.

Primary Presenter

Isabella Mark

Status

Undergraduate

Authors

Isabella Mark

Wenda Liu

Christopher Korn

Gabriela Rosenblau

Research Mentor/ Department Chair

Gabriela Rosemblau

RESEARCH SHOWCASE

PSYCHOLOGICAL AND BRAIN SCIENCES

Experienced Emotion: a Contributor to the Positive Valence Acquisition of Non-social Stimuli Associated with High Cognitive Effort

Emotion results from our action, and in turn emotion affects our action. The current study aims to investigate the emotional consequence of cognitive performance. For successful cognitive performance, it is critical to exert the proper level of cognitive control, which refers to the processes of focusing on task-relevant information while ignoring any distractor stimuli; however, cognitive control is costly. Previous research shows that the level of cognitive control associated with a stimulus can foster different emotional consequences. For example, social stimuli (e.g., human faces) associated with a high level of cognitive control can acquire positive valence. In one study, participants first performed a gender recognition task, in which they identified the apparent gender of a face while ignoring the superimposed gender word. The researchers found that faces that frequently appeared with incongruent distractors (e.g., female face superimposed with "MALE") were subsequently recognized faster when the faces expressed positive rather than negative emotion. In other words, this study shows that stimuli requiring increased cognitive control can become associated with the detection of positive emotion in faces. However, it is still unclear whether perceiving emotion in high-control faces impacts participants' experienced emotions. The current study, supported by the 2022 STEM Summer Internship, examined if participants' emotional state matched the positivity bias associated with high-control stimuli. Participants performed a color Stroop task by identifying the color of a color patch while ignoring an overlapping distractor color word. One group of participants received 80% congruent trials (the low cognitive control condition), while the other group received 20% congruent trials (the high control condition). Throughout this task, participants were occasionally asked to rate their mood on a 5-point visual analogue mood scale, with 1 being very negative and 5 being very positive. Results show that the 20% congruent group rated their mood more positively than the 80% congruent group, implying that the results in the previous studies may be due to the change of subjective feeling as a consequence of manipulating cognitive control. Overall, this more thorough understanding of how experienced emotion causes changes in valence acquisition within cognitively demanding tasks will help to better equip individuals with the knowledge of how emotional regulation could potentially improve their performance in academic, professional, or other settings.

Primary Presenter

Lily Reck

Status

Undergraduate

Authors

Lily Reck

Rebeka Almasi

Sarah Malykke

Myeong-Ho Sohn

Research Mentor/ Department Chair

Myeong-Ho Sohn

RESEARCH SHOWCASE

PUBLIC POLICY AND

PUBLIC ADMINISTRATION

Using Auxiliary Data to Guide the Recruitment of Sites for Randomized Controlled Trials

Sampling methods such as stratified random sampling (SRS) can be used to select representative samples of schools for randomized controlled trials (RCTs) of educational interventions. However, these studies may still suffer from external validity bias when participation by schools is voluntary and participation decisions are associated with unobserved variables. This scenario is not uncommon, given the limited data available for building sampling frames, which typically lack information about strong moderators of the intervention's impacts.

This paper introduces and tests a new sampling method called stratified random sampling with quotas (SRSQ). SRSQ augments SRS with sample quotas calculated for auxiliary variables that cannot be included in the sampling frame because information is not available at school level, but can be determined for selected schools during recruitment. To assess if SRSQ reduces the external validity bias of sample estimates, simulations to compare SRSQ to SRS were conducted with data from the 2018-19 Common Core of Data (CCD), School Universe Survey.

Our simulations find that setting and applying sample quotas based on an impact moderator that influences school participation decisions can substantially reduce external validity bias. This result held when sampling from all K-5 schools in the U.S. or when sampling from all but the smallest states. These results suggest that when external data or reports provide evidence on the mean values of strong impact moderators for the RCT's target population, quotas can be used to address non-ignorable self-selection by schools into RCTs.

Primary Presenter

Maria Luisa Vásquez Rossi

Status

Graduate

Authors

Robert B. Olsen

Maria Luisa Vasquez Rossi

Research Mentor/ Department Chair

Robert B. Olsen

RESEARCH SHOWCASE

ROMANCE, GERMAN, AND SLAVIC LANGUAGES AND LITERATURES

Los Tigres del Norte and the Construction of Migrant Identity

The rise of digital streaming has significantly impacted the way the average listener consumes music. One such transformation centers on the design of album covers. Artists have historically used album covers to reinforce their unique identity and message. In the post-album era, however, music listeners view album covers as small icons on their preferred streaming platform, leading to a detachment between music and artwork. Despite this shift, this research study will analyze how Los Tigres del Norte, a norteño band formed in the late 1960s, has utilized album covers to shape their Pan-American identity, leading to their title as “la voz del pueblo” (*voice of the people*).

Primary Presenter

Johanna Cajina

Status

Graduate

Authors

Johanna Cajina

Research Mentor/ Department Chair

Manuel Cuellar

RESEARCH SHOWCASE

ROMANCE, GERMAN, AND SLAVIC LANGUAGES AND LITERATURES

Aesthetics of Testimony: Mayan Women as the Guardians of Cultural Memory

Throughout history, indigenous peoples and cultures have been politically and militarily targeted and exploited. In this paper I will explore the specific case of the Mayan descendant, indigenous communities of Guatemala and their experiences during the country's 36-year civil war. Despite the overwhelming prevalence of this discriminatory violence against the Quiche people, the combination of amnesty laws and the devastating lack of survivors make it so that the majority of the information about the Mayan experience in Guatemala from 1960-1996 comes to us from the testimonies of those who escaped death. I will analyze several testimonies and media representations of the conflict such as *Me llamo Rigoberta Menchu y así nació la conciencia* (1983) and *La Llorona and Ixcanul* by Jayro Buscante (2019 and 2015) to demonstrate the dangerous ramifications of popular amnesty policies following periods of war, as well as the imminent risk of erasure that comes with the dismissal of women's testimonies as sources of historical fact. Looking deeper into the social and cultural context of the Mayan genocide, I will question the possibility of reparation within a nation whose own government has facilitated the murder of its own people. This paper will prompt discussion surrounding the particular victimization of indigenous women during the Mayan genocide by emphasizing their unique vulnerability as gestational beings as well as their unparalleled position as the sole witnesses, storytellers, and guardians of cultural memory.

Primary Presenter

Clare McNabb

Status

Undergraduate

Authors

Clare McNabb

Research Mentor/ Department Chair

Manuel Cuellar

RESEARCH SHOWCASE

ROMANCE, GERMAN, AND SLAVIC LANGUAGES AND LITERATURES

The Empowerment of Dominican Women Through Literature

The Caribbean is often portrayed as an exotic paradise where tourists can visit and partake in various “adventures” allowing them to forget their problems and responsibilities in their home country. Ranking #1 in ForwardKeys 2022 Most Visited Destinations report, the Dominican Republic reinforces this paradise stereotype as exemplified via their slogan “Republica Dominicana lo tiene todo”, Dominican Republic has it all. However, what is often omitted from this marketing strategy is the real-life challenges of the natives living in this glamorized third world country and the root of colonialism within the Dominican culture and the tourism industry. This paper examines *Dominicana* by Angie Cruz and *The Poet X* by Elizabeth Acevedo to provide a different perspective of the 2022 most visited destination and to better understand the experiences of Dominicans in the diaspora. *Dominicana* by Angie Cruz and *The Poet X* by Elizabeth Acevedo illustrate how Dominican women are often silenced through extreme sexual objectification, but the diaspora creates an exposure to independence resulting in the rejection of colonialist rooted ideologies and the empowerment of Dominican women.

Primary Presenters

Nachelyn del Carmen

Reyes Martinez

Status

Undergraduate

Authors

Nachelyn del Carmen

Reyes Martinez

Research Mentor/ Department Chair

Manuel Cuellar

RESEARCH SHOWCASE

SOCIOLOGY

Thicker Than Water: Hamilton's Rule in Panhellenic Families

Hamilton's rule provides a causal explanation for the selection of altruistic behavior. By factoring in the coefficient of relatedness, a behavior may be selected for in a scenario when the benefit to the recipient, multiplied by the coefficient of relatedness, is greater than the cost to the altruist. Given the complexities of human society, families are not always formed through genetic connections. The relationships between "big sisters" and "little sisters" in Panhellenic sororities go beyond the expectations of friendships, forming their own self-identified families on the tenants of fraternal sisterhood. This study explores the application of Hamilton's rule in big-little relationships. Through an online survey, respondents answered questions about their relationships with their bigs and littles. This established a measure of perceived closeness which served as a proxy for genetic relatedness. Respondents were then asked to assess their propensity to engage in altruistic behavior in three scenarios related to their status as panhellenic members, women, and college students. Each scenario contained an introductory scenario, and two additional questions that introduced an increased cost to altruists or an increased benefit to the recipient. Preliminary data indicated a correlation between relatedness and one's likelihood to perform an altruistic action. The likelihood is greater for bigs helping littles than vice versa, but overall the positive association was present in both directions. These results provide an insight into the elusive bonds formed between bigs and littles. Further research is needed to determine whether these results hold among the Panhellenic community at other universities, other organizations within Fraternity and Sorority life, or between alternative types of self-identified families.

Primary Presenter

Grace Hallam

Status

Undergraduate

Authors

Grace Hallam

Research Mentor/ Department Chair

Carly Jordan

RESEARCH SHOWCASE

SOCIOLOGY

Modernity & Massianism: QAnon as a Case of Reactionary Messianic Nationalism

Since its birth in 2017, QAnon has become a remarkably popular conspiracy theory, spreading to as many as 45 million Americans. Because it is relatively young, few answers have been given as to the cause and function of the QAnon conspiracy movement in today's society. I argue that QAnon can be seen as a messianic nationalist conspiracy theory born from the cultural displacement incurred by relentless modernity. I begin by advancing the functionalist approach of Peter Berger, arguing that the secularization inherent in a modernizing capitalist order presents an existential threat to the religious "nomos". I also demonstrate how political conspiracy and messianic nationalism are two frequent reactions to the "anomy" brought about by rapid social change. I apply this to the case of 20th century European antisemitic conspiracies, drawing from the modernism of Zygmunt Bauman. I then use this mechanic to describe American culture, arguing that today's unprecedented secularization and diversification has plunged American Christian nationalists into a state of anomic uncertainty. QAnon can best be understood as a reaction to this anomy, allowing the culturally disenfranchised to reframe and resist rapid social change through empowering messianic mythologies. This contributes to the literature by depicting QAnon not as an anomaly but as the latest instance in a long line of similar responses to similar forces.

Primary Presenter

Skyler Kelley Duval

Status

Undergraduate

Authors

Skyler Kelley Duval

Research Mentor/ Department Chair

Daina Eglitis

RESEARCH SHOWCASE

SPEECH, LANGUAGE AND HEARING SCIENCES

Representation of Participants of Color, Women and Transgender people in Autism Research: A Review

Where are the people of color, women, and transgender people with Autism Spectrum Disorder (ASD)? They are certainly not present in Autism research. This review catalogs the race and ethnicity, sex assigned at birth, and gender of participants in Autism research to establish a relationship between these demographic characteristics and disparities associated with them in the diagnosis of and service provision for ASD. This study examines 512 research articles published in six leading peer-reviewed journals in ASD research, as follows: Journal of Autism and Developmental Disorders (JADD), Autism, Autism Research, Molecular Autism, Autism in Adulthood, and Research in Autism Spectrum Disorders between January 2022- June 2022. A comprehensive process was used to identify research that: 1) was quantitative, 2) carried out in the United States 3) completed with human participants, and 4) included participants with ASD. The 129 research articles that met the four criteria above were reviewed to catalog race and ethnicity, sex, and gender reported to provide empirical evidence for the lack of representation of participants of color, women, and transgender people in Autism research. Of the 129 articles, only 64% reported the race and ethnicity of their participants. Among these, the majority of the participants were White. Only 28% reported the sex of the participants. Among these, the number of female participants was usually reported, but female participants were often excluded from the research itself. Lastly, only 8.5% of the research articles reported the gender of the participants. These findings are important as they highlight the dominance of White, cisgender, and male participants in ASD research. This creates a White, cisgender, and male lens through which ASD is studied, reinforcing the idea that ASD only affects white cis men. In addition, it limits our understanding of the Autistic experience. We do not understand in what ways ASD presents in people of color, women, and transgender people. This work is a starting point in understanding how by mainly including White, cis, and male participants, ASD research has been creating a cycle of structural racism, sexism, and transphobia which is leading to racial, sex, and gender-based disparities in the information, screening, diagnosis, and services of ASD.

Primary Presenter

Neha Ahmed

Status

Undergraduate

Authors

Neha Ahmed

Gregory Wallace

Research Mentor/ Department Chair

Gregory Wallace

RESEARCH SHOWCASE

SPEECH, LANGUAGE AND HEARING SCIENCES

Are Parkinsonism Features Stable and Linked to Other Aging-Related Concerns Among Middle and Older Age Autistic Adults?

Emerging evidence links parkinsonism (i.e., motoric features associated with Parkinson's Disease, such as limb stiffness and bradykinesia) with autism during middle and older adulthood. However, research to date has been limited to cross-sectional studies only; no studies have examined whether parkinsonism features change over time. Additionally, it is unclear if there are links between these parkinsonism features and other aging-related concerns, such as cognitive decline and falls, among middle and older age autistic adults. This project examines change in parkinsonism features over a two-year period and contemporaneously investigates associations between parkinsonism features and both subjective reports of cognitive decline and falls during middle and older adulthood in autism. 210 autistic adults (58% female) ranging in age from 43-81 ($M=56$) years were recruited via Simons Powering Autism Research (SPARK) Research Match and completed a series of online questionnaires two years after their original study participation. The presence of parkinsonism features was evaluated using the Parkinsonism Screening Questionnaire (PSQ)⁵ at both Time 1 and Time 2. Subjective cognitive decline was measured using the Eight-item Interview to Differentiate Aging and Dementia¹⁴ (AD8) at Time 2. The presence and number of falls a participant had experienced in the last year were also queried at Time 2. Repeated measures analysis of covariance and a partial correlation, both accounting for the effect of lifetime antipsychotic medication exposure, were used to examine change in parkinsonism features over time and associations between parkinsonism features and subjective reports of cognitive decline at Time 2, respectively. Additionally, independent samples t-tests were used to evaluate whether autistic adults reporting falls also reported greater parkinsonism features at Time 2. Parkinsonism features demonstrated a small but significant improvement (Time 1: $M=3.63$, $SD=4.02$; Time 2 $M=2.64$, $SD=3.53$) over the course of two years in this sample of middle and older age autistic adults, even after accounting for antipsychotic exposure ($F=6.04$, $p=.015$). However, screen positive rates for parkinsonism using the PSQ remained high (28.6%). Partial correlations revealed that increasing parkinsonism features were significantly associated with increased reports of subjective cognitive decline ($r_s=.32$, $p<.001$; see Figure 1) even after accounting for antipsychotics exposure. Finally, autistic adults who reported experiencing falls ($n=44$) rated themselves as having significantly more parkinsonism features than those who did not experience falls ($t=2.00$, $p=.047$).

Primary Presenter

Mohammed Almarkhan

Status

Undergraduate

Authors

Gregory L. Wallace

Goldie A. McQuaid

Mohammed Almarkhan

Rebecca Charlton

Katie Daugherty

Research Mentor/ Department Chair

Gregory L. Wallace

RESEARCH SHOWCASE

SPEECH, LANGUAGE AND HEARING SCIENCES

Does Disgust Contribute to Picky Eating in Autistic Adults?

This study examines the relationship between picky eating and disgust in autistic adults and neurotypical adults. Further, it aims to determine whether the relationship between picky eating and disgust is mediated by sensory processing in autistic adults. 252 young autistic adults were recruited via Simons Powering Autism Research (SPARK) Research Match and 145 neurotypical adults were recruited via Qualtrics to serve as a comparison group for the autistic adults. This study focused on assessing the constructs of picky eating, disgust, and both olfactory and oral texture sensitivities using an online battery of widely used and psychometrically sound questionnaires about eating-related behaviors and their potential correlates. Linear regressions revealed significant associations between disgust processing and picky eating even after accounting for covariates. Oral texture (unlike olfactory) sensory processing significantly mediated the relationship between disgust processing and picky eating though the direct relationship between disgust and picky eating remained statistically significant as well. Since the research shows that disgust plays a role in picky eating and downstream health effects, this gives us another “route” to intervene and improve health outcomes for people with ASD via eating habits.

Primary Presenter

Amrita Grewal

Status

Graduate

Authors

Amrita Grewal

Gregory L. Wallace

Goldie A. McQuaid

Laura Barrett

Emily Kushner

Research Mentor/ Department Chair

Gregory L. Wallace

RESEARCH SHOWCASE

SPEECH, LANGUAGE AND HEARING SCIENCES

The Psychosocial Impact of Stuttering in Children Through Their Own Voices

Topic & Previous Research: Few research studies address the lived experience of stuttering for children who stutter (CWS). This research study attempts to fill in these gaps via qualitative analysis of interviews of children who stutter ages 8-17. A recent meta-analysis documented increasingly negative attitudes toward communication in children who stutter (when compared to children who do not stutter) in the school-age years (Stokke Guttormsen, Kefalianos, & Naess, 2015).

Methods: Qualitative analysis was performed according to methods set forth in the literature (Braun & Clarke, Creswell & Poth, Syed & Nelson, 2015). A team of researchers were split into two distinct teams of coders and coding judges. Two coders individually analyzed each line of transcribed interviews and denoted essential aspects of each. The coding pair then used those initial codes to create agreed upon codes, which were reviewed by two code judges. Two themers then individually extracted overarching themes that captured the coded content. These two judges then reviewed and discussed the themes and arrived at consensus.

Findings: **Question 4: Can you tell me about your talking?**

Theme 1: CWS identify times when it is easier or harder to talk.

Subtheme 1: Dependent on situations.

Subtheme 2: Dependent on modes of speech.

Subtheme 3: Dependent on affective states.

Theme 2: CWS identify the variability and unpredictability of their stutter

Subtheme 1: Over time.

Subtheme 2: From situation to situation.

Subtheme 3: Types of stuttered speech.

Question 6: Have you had speech therapy? Is there anything you'd like to say to people who want to become speech therapists?

Theme 1: SLPs who work with CWS should be patient and knowledgeable about stuttering.

Theme 2: Because some treatments work better than others, CWS should be given agency in therapeutic goal setting.

Subtheme 1: Speech tools may eventually stop working.

Subtheme 2: Offer opportunities to connect with the community of PWS.

Subtheme 3: Feelings and attitudes about stuttering should be a focus.

Significance: These findings offer a glimpse into the lived experiences of young people who stutter, both in their daily lives and in therapeutic settings. They reinforce the idea that young people are the experts of their own stutters and should be entrusted with an active role as goal setters in speech therapy.

Primary Presenter

Julia Kerrigan

Status

Undergraduate

Authors

Julia Kerrigan

Research Mentor/ Department Chair

Shelley Brundage

RESEARCH SHOWCASE

STATISTICS

Properties of non-uniform recycling hypergraphs.

Hypergraph modeling is a growing area at the intersection of probability theory and statistics with many applications in computer science, social sciences, medical science, genetics, engineering, marketing and business. In our framework, we investigate the properties of non-uniform recycling hypergraphs, which are structures with a fixed number of vertices. These vertices are sampled repeatedly and independently to form sets of fixed size—the hyperedge size and appear in sets with different probabilities which. We build a probability model and derive some properties of the containment level of specific vertices and the number of vertices contained at a specific level.

In the probability model, we construct the sample space, the points in which are every possible combination of vertices of the hyperedge size. We then generate a suitable sigma field and impose a probability measure on it. Based on the probability model, we define the popularity number of a vertex as the sum of probabilities of all combinations containing this vertex. In this model, the sum of all popularity numbers is equal to the hyperedge size. Note that while we can get the popularity numbers from the probability measure, we cannot construct the measure uniquely from the popularity numbers.

For the containment level of a specific vertex, we obtain the exact mean, variance and covariance of the containment level of that vertex. Consequently, we derive a multivariate Gaussian limit law for the joint containment levels of the various vertices.

As for the containment at a specific level, we obtain its exact mean and find the containment level with the largest average number of vertices analytically in the uniform case. For non-uniform cases, analytic results seem to be out of reach at this stage of research. Therefore, for non-uniform cases, we demonstrate the practical value of our theoretical results through extensive simulation studies.

Primary Presenter

Chengyi Yang

Status

Graduate

Authors

Tatiana Apanasovich

Chengyi Yang

Hosam Mahmoud

Research Mentor/ Department Chair

Hosam Mahmoud

Tatiana Apanasovich

RESEARCH SHOWCASE

STATISTICS

Independence-Encouraging Subsampling for Nonparametric Additive Models

The additive model is a popular nonparametric regression method due to its ability to retain modeling flexibility while avoiding the curse of dimensionality. The backfitting algorithm is an intuitive and widely used numerical approach for fitting additive models. However, its application to large datasets may incur a high computational cost and is thus infeasible in practice. To address this problem, we propose a novel approach called independence-encouraging subsampling (IES) to select a subsample from big data for training additive models. Inspired by the minimax optimality of an orthogonal array (OA) due to its pairwise independent predictors and uniform coverage for the range of each predictor, the IES approach selects a subsample that approximates an OA to achieve the minimax optimality. Our asymptotic analyses demonstrate that an IES subsample converges to an OA and that the backfitting algorithm over the subsample converges to a unique solution even if the predictors are highly dependent in the original big data. The proposed IES method is also shown to be numerically appealing via simulations and a real data application.

Primary Presenter

Yi Zhang

Status

Graduate

Authors

Lin Wang

Xiaoke Zhang

Haiying Wang

Research Mentor/ Department Chair

Lin Wang

Xiaoke Zhang

RESEARCH SHOWCASE

WOMEN'S GENDER AND SEXUALITY STUDIES

Two Sides of Feminism in China: Feminist Shaming and Potential Empowerment

This research explores the relationship between the shaming of feminists on Chinese social media and the potential empowerment of women via education about Chinese feminism. The study first explores the history of feminism in China, its diverse and dynamic components, and its progress in areas such as women's rights, reproductive freedom, and LGBTQ rights. Then it proceeds to identify the concept of feminist-shaming, which means making resentful and negative comments about people's belief in feminism or women's rights. Feminist shamers label Chinese women as disrespectful, ungrateful, and selfish because their minds do not align with Chinese Confucianism, the foundation of Chinese culture. Confucian ideas shape historical traditions that regulate women's behaviors. Confucianism is highly correlated with the shaming of feminists. Lastly, the study identifies the influence of feminist education and determines whether feminist education can bring potential empowerment to Chinese women. This study uses quantitative and qualitative approaches to explore whether feminist education could bring potential empowerment. I distributed a 12-question survey to Chinese international students at UCSB to learn if students took any feminist courses and saw any obstacles to feminism or feminists in China. From the survey response, I drew five students for an in-depth interview to better identify Chinese students' knowledge of feminism before they came to the US and after they took UCSB courses. I believe that a proper education in feminism would be potentially helpful for Chinese women and would help the public attitudes toward feminism. This research topic is unique because it unpacks how feminist-shaming is connected to Confucian values.

Primary Presenter

Jenny Cai

Status

Graduate

Authors

Jenny Cai

Research Mentor/ Department Chair

Eileen Boris

Ashwini Tambe

RESEARCH SHOWCASE

WOMEN'S, GENDER AND SEXUALITY STUDIES

Texts Analysis of Indonesian Bride Kidnapping Practice in Indonesian and English Language

In a world currently voicing women's equality and women's rights to determine their lives, in Sumba, Indonesia there are cases where women's freedom and their right to determine whom to marry is constrained, as many are still subjected to bride kidnapping. In 2020, a video (Official iNews 2020) of a woman forcibly arrested by several men to be taken to be wed to another man went viral. This video sparked discussions on bride kidnapping in Indonesia and was widely reported in Indonesian and English language media. The variety of media content stemming from this incident communicated differing social and cultural reasons for why this practice continues to exist. Using a content analysis, I analyze how bride kidnapping is depicted through Indonesian and English texts to broaden the scope of understanding in which people view the practice. Indonesian media tends to include a more comprehensive context detailing local cultures and beliefs, while English-language texts overlook specific nuances in this practice by focusing on oppression and violations of women's rights. As an Indonesian woman studying in the United States, I rely on my cultural background, transnational experiences, and Indonesian and English language fluency to analyze these various themes. Initial findings demonstrate bride kidnapping is a widespread problem not only affecting Indonesian women in Southeast Asia, but is also prevalent in Kyrgyzstan in Central Asia, China in East Asia, and Nigeria in West Africa. Even though each of these practices have their own distinct cultural nuances, in each context we see how women's freedom and agency is impacted, hence bride kidnapping cases must be addressed. Frequent themes emerging from Indonesian texts include clarification of how current practices and cultural values are upheld by the people of Sumba. Underlying arguments indicate the practice of bride kidnapping is an initial stage of marriage followed by an agreement between two families and customary wedding procession, thereby justifying the sanctity and moral tenets of the practice. Alternatively, recurring themes in English texts include the rights of women who lack the authority to negotiate and advocate for themselves, as well as the physical, psychological, and sexual harm women endured by the kidnapping. The author argues that the distinctions between how the practice is portrayed in English and Indonesian texts should inform understandings of gender, women's power, and agency, and urge us to rely more on Global South perspectives when analyzing Global South issues and problems.

Keywords: Bride kidnapping, Bride Abduction, Forced Marriage, Women's rights

Primary Presenter

Martha Yesidaneska
Sooai

Status

Graduate

Authors

Martha Yesidaneska
Sooai

Research Mentor/ Department Chair

Sabrina J. Curtis

RESEARCH SHOWCASE

WOMEN'S, GENDER AND SEXUALITY STUDIES

The Online Self-Representation of Lesbian Family Reproduction in China

Researchers interested in Chinese LGBTQ issues have investigated how same-sex couples in China access artificial reproductive technologies (ART) in family formation in real life, but much less is known about the online presence and representation of same-sex family formation and how traditional gender roles impact that representation. Same-sex couples are starting to share their own family planning process online and are shaping their narratives of queer parenting. Lesbian couples, especially, are vocal in sharing their experience in accessing ART and planning a family with their loved ones despite state censorship on the online discussion of homosexuality. This study, therefore, sets out to explore how lesbian couples in China represent their family formation process online and how they use traditional gender roles in shaping that representation, using data gathered from a popular social media platform named Xiaohongshu (RED). The study used certain codes that Chinese lesbians use within the lesbian community to identify lesbian users on RED who share their family formation process. The paper reviews concepts such as homonormativity, censorship, patrilinealism, lesbian gender roles, and queer reproduction in China and uses these concepts as the theoretical framework to analyze RED lesbian users' online self-representation of their family formation. It was found that discussions of in-vitro fertilization (IVF), parental approval, and affording the child "fatherly love" were the most prevalent in the selected users' posts. The study concludes that the users' online self-representation mainly involved combatting heteronormative narratives of family structures and it is clear they are attempting to disrupt this narrative by inserting themselves and their family's presence into the internet space. However, possibly due to the lack of vocabulary available to discuss queer experiences in China, their use of certain words and rhetoric inadvertently reinforces some heteronormative ideals of family, which suggests the sentiment of homonormativity and their underlying desire to fit into a heteronormative framework of a family. This study contributes to existing knowledge of Chinese lesbian reproduction by providing data and analysis of lesbian parents' self-representations on social media. The findings will be of interest to researchers acquiring knowledge of lesbian social media presence and culture.

Primary Presenter

Zhangzhu Wan

Status

Undergraduate

Authors

Zhangzhu Wan

Research Mentor/ Department Chair

Cynthia Deitch

RESEARCH SHOWCASE

WOMEN'S, GENDER AND SEXUALITY STUDIES

Prevalent Barriers to Parenting Experienced by Polyamorous Parents

It is estimated that 4-5% of adults in the U.S. are in some form of polyamorous relationship. Some of them have children. How do they experience parenting?

Polyamory is a form consensual non-monogamy where people engage in multiple romantic relationships at the same time with the consent and knowledge of all parties involved. It is differentiated from swinging and polygamy. There are many different types of polyamory with differing relationship structures, all with a focus on open communication and honesty and a requirement of all parties involved knowing and consenting to what is going on. There can be hierarchical and non-hierarchical relationships, some partners not all seeing each other, and more. The purpose of this paper is to address the question "What are the most prevalent barriers to parenting experienced or perceived by adults in a polyamorous relationship?"

Interviewees were recruited from various polyamory groups online by posting information about the paper and stating that data would be de-identified, and six people participated in an in-depth interview with a guide of fifteen open-ended questions for the researcher to ask and use as jumping points. All interviewees consented to being recorded and those recordings being transcribed.

It is difficult to generalize due to the small sample size, but the interviews show that some prevalent issues that polyfamilies face are stigma and worries about legalities of being a guardian. Due to the many different relationship structures that are possible in a polyamorous relationship. Some future roads of research are to specifically search for polyfamilies where everyone is seeing each other equally and discuss how that is navigated in terms of parenting, putting a focus on polyamorous people of color, or asking children of polyfamilies questions about how they were raised. Another future research project could involve a survey instead of interviews, which could generate a much larger sample size, but there would not be a chance to ask specific questions of each person taking it.

Primary Presenter

Maya Younes

Status

Undergraduate

Authors

Maya Younes

Research Mentor/ Department Chair

Cynthia Deitch

THANK YOU TO OUR RESEARCH MENTORS!

Andrei Afanasev
Reem AlRabiah
Elisabeth Anker
Eyal Aviv
Peg Baratt
W. Andrew Barr
Nicole Bartels
Catherine M. Bollard
Eileen Boris
Alberto Bosque
Brenda J. Bradley
Shelley Brundage
Denver Brunzman
Olivia Bullock
Christopher L. Cahill
Christopher Campos
Jonathan Chaves
Liana Chen
Katherine B. Chiappinelli
Alex Cromwell
Manuel Cuellar
Sabrina J. Curtis
Kavita Daiya
Cynthia Deitch
Michael Doering
Hongyuan Dong
Diana Eglitis
Ioannis Eleftherianos
Ryan Engstrom
Rohan Fernandes
Michele Friend
Keryn Gedan
Christina Gee
Fallon R. Goodman

Leon Grayfer
Kimberly Gross
Eric Grynaviski
Thomas A. Guglielmo
Ling Hao
Sarah Hlubik
Jyoti Jaiswal
Aleksandar Jeremic
Carly Jordan
Xiaofei Kang
Jakub Kostal
Chryssa Kouveliotou
Joel Kuipers
Vera Kuklina
Sharon Lambert
Eric Lawrence
Jiyoung Lee
Joel B. Lewis
Wei Li
John Lill
Meina Liu
Sanjay B. Maggirwar
Hosam Mahmoud
Michael A. Massiah
Raja Mazumder
Joseph Meisel
J. Houston Miller
Stephen Mitroff
Kelsey E. Nyland
Damien O'Halloran
Bibiana Obler
Nils Olsen
Robert B. Olsen
Robert Orttung

Suleiman Osman
Weiqun Peng
Yisheng Peng
Abigail M. Polter
Nikki Posnack
Jordan Potash
Józef H. Przytycki
Judith Racusin
Mark Reeves
Gabriela Rosenblau
Marya Rozanova-Smith
Dennis E. Schell
Axel Schmidt
Antonia Sepulveda
Maho Shibata
Nikolay I. Shiklomanov
Brett Shook
L. Courtney Smith
Stephen Smith
Myeong-Ho Sohn
Natalia Soriano-Sarabia
Michelle L. Stock
Dmitry Streletskiy
Ashwini Tambe
Pao-Lin Tien
Sarah Wagner
Gregory L. Wallace
Lin Wang
Chao Wei
Colin N. Young
Xiaoke Zhang
Yanxiang Zhao
Irene Zohn