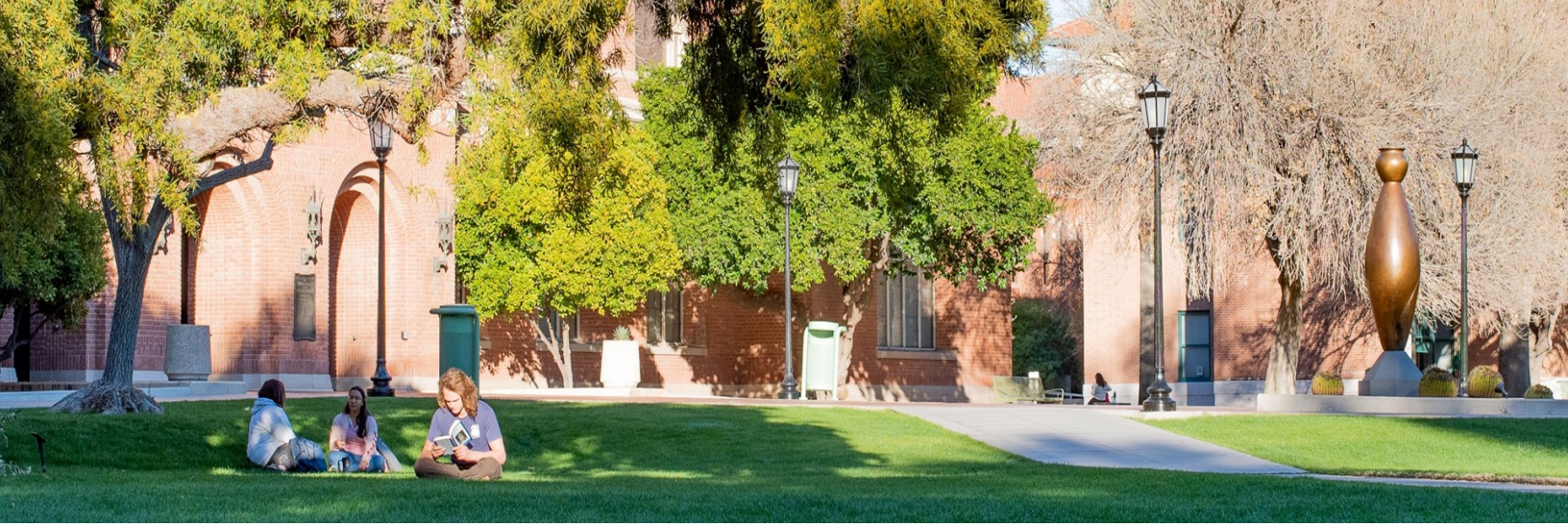

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE
Undergraduate Research
Opportunities Consortium

2024 Abstract Review

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UROC Introduction and Acknowledgements

The Undergraduate Research Opportunities Consortium (UROC) is managed by the University of Arizona Graduate College is comprised of eight undergraduate research programs. Six of the programs are managed by the Graduate College and two are affiliated programs sponsored by the National Science Foundation Research Experience for Undergraduates (NSF REU) Program. The objective of the consortium is to increase the number of underrepresented students who apply to graduate school. UROC Scholars engage in faculty-supervised research and participate in a comprehensive graduate school preparation program that includes graduate admission and funding workshops, presentation skills seminars and a professional research conference experience. We invite you to enjoy the UROC Student Abstract Review and share in the students' success.

The UROC 2024 Abstract Journal was
Edited by: UROC Staff & Students
Designed by: Tianna Urrea MacMeans, UROC Program Coordinator and
Victoria Juvera, McNair Administrative Assistant
Photographed by: Angela Pittman

Undergraduate Research Opportunities Consortium
Located at the University of Arizona
Graduate Center
1600 E. 1st St.
Tucson, AZ 85719

We respectfully acknowledge the University of Arizona is on unceded land of Indigenous peoples. Today, Arizona is home to 22 federally-recognized tribes, with Tucson being home to the O'odham and the Pascua Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with Arizona's Native Nations and tribal communities through education offerings, partnerships, and community service.

2024 UROC Programs and Sponsors

UROC Graduate College Programs

Access, Wellness, And Relational Determinants of Student Success (AWARDSS) Publishing, policy, practice, Leadership and life-long learning for Underrepresented Students (PLUS) Training Program
PI: Michelle M. Perfect, PhD
Co-PI: Brandy A. Brown Perkl, PhD
Coordinators: W. Haydon Ekstrom, MA
Graduate Teaching Assistants: Mary L. Bankhead, MS; Melinda Willet Struyk, MA; Lidia Azurdia Sierra, MPH; Kia Schott, and Cori Manning
Sponsors: Institute of Educational Sciences, U.S. Department of Education, (Award: #R305B20019), University of Arizona Graduate College

Maximizing Access to Research Careers (MARC)
PI/Director: Katrina Miranda, PhD
Co-Director: Sam Campos, PhD
Assistant Director: Cindy Neal, MEd
Sponsors: National Institute of General Medical Sciences of the National Institutes of Health (NIGMS-NIH)

Minimizing Health Disparities (MHD)
Program Coordinator: Tianna Urrea MacMeans
Facilitators: Cindy Neal, MEd and Tianna Urrea MacMeans
Sponsors: Western Alliance to Expand Student Opportunities (WAESO), University of Arizona Graduate College

Ronald E. McNair Postbaccalaureate Achievement Program (McNair)
PI/Program Director: Caitlin Rosario Kelly, ABD
Administrative Assistant: Victoria Juvera
Graduate Teaching Assistant: Astrid Liu
Sponsors: U.S. Department of Education, Federal TRIO Program, Ronald E. McNair Postbaccalaureate Achievement Program (Award: #P217A220105), Western Alliance to Expand Student Opportunities (WAESO), University of Arizona Graduate College

Summer Research Institute (SRI)
Program Coordinator: Tianna Urrea MacMeans
Instructor: Leah Callovini, MA
Co-Instructor: Tianna Urrea MacMeans
Graduate Teaching Assistants: Sergio Castro and Nathaniel Gallegos
Sponsors: University of Arizona Graduate College and Western Alliance to Expand Student Opportunities (WAESO)

UROC-Prep
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Instructor: Leah Callovini, MS
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UROC Affiliate Programs

ASEMS Scholar Training Academy for Research in STEM (STARS)
PI: Jennifer Batchelder, PhD
Co-PI: Rebecca Gomez, PhD
Co-PI: Nura Dualeh, MA
Coordinator: Leah Callovini, MS
Instructor: Leah Callovini, MS
Graduate Teaching Assistants: Melinda Willet Struyk, MA, ABD; Lidia Azurdia Sierra, MPH
Sponsors: Gordon and Betty Moore Foundation, Arizona Science, Engineering, and Math Scholars (ASEMS) Program, University of Arizona Graduate College

Biosphere 2: Research for Environmental Solutions (B2 REU)
PI: Katerina Dontsova, PhD
Co-PI: Kevin Bonine, PhD
Sponsors: National Science Foundation Research Experiences for Undergraduates (NSF REU) Program and University of Arizona Graduate College

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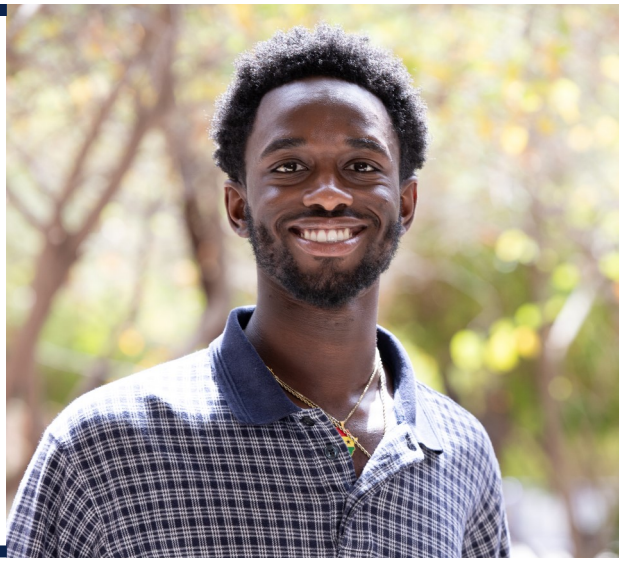
Sponsors: Institute of Educational Sciences, U.S. Department of Education, (Award: #R305B20019), University of Arizona Graduate College

Ephraim Amissah

Leadership and Learning Innovation at
University of Arizona

Mentored by Lia D. Falco, PhD and Renae D. Mayes, PhD, NCC (Disability and Psychoeducational Studies)



Focus & Flourish: Supporting ADHD in the Classroom

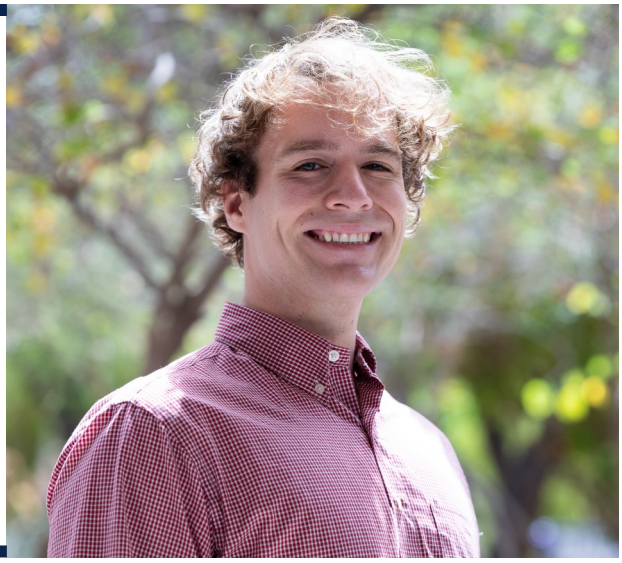
Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder characterized by either predominantly hyperactive/impulsive behavior, predominantly inattentive behavior, or a combination of the two. Individuals with ADHD face difficulties in the classroom, but Black, indigenous, and people of color (BIPOC) face more unique, significant challenges than their White peers which adds to the present systemic injustices in schools leading to lower academic achievement, less access to learning and support services, all while having a higher rate of discipline. How can school-based interventions support BIPOC students with ADHD thriving in secondary school? Implementing a holistic approach that addresses academic and socio-emotional well-being will decrease disparities while increasing outcomes for BIPOC students with ADHD. In this qualitative study, the academic experiences of middle and high school students age 12-18 will be explored. Through a semi-structured interview format, questions providing insight on effective/ineffective intervention methods, presence of school support systems, relationships with teachers/peers, ADHD diagnosis information, and other related topics will be asked.

This study aims to explore current culturally responsive interventions/support systems for BIPOC students with ADHD, analyze their effectiveness, and propose a plan for implementation in secondary schools.

Graham Bliss

Psychology at University of Arizona

Mentored by Jessica Andrews-Hanna, PhD and Mariam Hovhannisyan (Psychology)



Individual Differences in Imaginative Cognition:
The Dynamic Interaction of Mind's Mind and Mind's Eye in Learning

Imaginative cognition, involving abstract (mind's mind) and concrete (mind's eye) forms of thinking, may play a crucial role in learning. However, relatively little research has examined individual differences using a neurocognitive framework to better understand learning. Additionally, there is a dearth of knowledge on how imaginative differences manifest within older adults. Here, we examine how individual differences in imaginative cognition are reflected in autobiographical event memory and resting state cognition in both young and older adults. In addition, we examine whether these two forms of thinking are related to a verbal memory test, the California Verbal Learning Test (CVLT), and a visual memory test, the Rey-Osterrieth Complex Figure Test (RCFT) in older adults. Eighty-three participants underwent neuropsychological assessment and two different narrative-based imaginative thinking tasks. First, we found that older adults, compared to young adults, used more of the mind's mind in the autobiographical event memory task, whereas young adults used more of the mind's eye. We did not find a significant difference in the use of the mind's eye and mind's mind between young and older adults on the resting state cognition task. Second, we did not find a relationship between the use of mind's mind and the CVLT or use of the mind's eye and RCFT. Our findings suggest the mind's eye and mind's mind varies by task type and between young and older adults. The findings offer valuable insights for improving educational strategies to better accommodate individual differences.

Ashley A. Foronda

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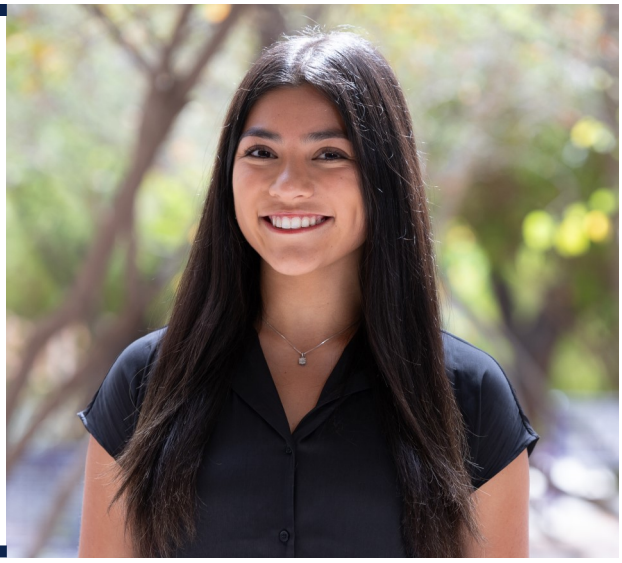


The Contribution of Trauma Histories and Symptoms on T1DM Students' School Performance and Attitude Toward School

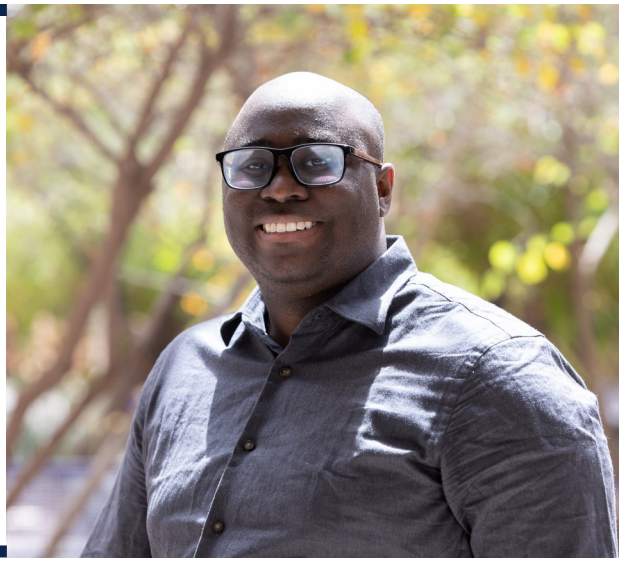
Understanding the interplay between childhood trauma, type 1 diabetes mellitus (T1DM), and educational outcomes is crucial due to the significant challenges faced by students with T1DM. This study explored the effects of trauma exposures and symptoms on students with T1DM, specifically its impact on academic performance and perceptions of school. The study uses a cross-sectional, quasi-experimental, and correlational design, using secondary data from the Family Routines Enhancing Adolescent Diabetes by Optimizing Management (FREADOM) study. Instruments used to evaluate variables include the UCLA PTSD Reaction Index for DSM-5 (caregiver and self-report) and the Behavioral Assessment Scales for Children-3rd Edition, Teacher Rating Scale, and Self Report of Personality. Those with multiple trauma exposures reported more negative attitudes toward school and had worse teacher-reported study skills than those with 0 or 1 trauma exposure. Trauma symptoms reported by the participant and caregiver were related to the students' attitude toward teachers and interest in school. Trauma symptoms also significantly contributed to poorer study skills, as reported by teachers. The intrusion symptom had the strongest association with the teachers' reported learning problems. These findings suggest the need to adopt trauma-informed approaches to mitigate the negative effects of trauma on students with T1DM. This research could inform the development of targeted interventions and support mechanisms within educational settings to better accommodate the needs of students with T1DM and trauma histories, ultimately improving their academic performance and well-being.

Keywords: Type 1 diabetes mellitus, childhood trauma exposures, academic performance, trauma symptoms, educational outcomes

Omozusi Guobadia

Master's of Public Health, Global Health at University of Arizona

Mentored by Jill M. Castek, PhD and Kacey Ernst, PhD, MPH (Teaching, Learning & Sociocultural Studies; Epidemiology and Biostatistics)



Misinformation and Public Health: A Framework to Address Issues and Challenges

Literacy is a vital skill necessary to successfully navigate healthcare systems and, more broadly, the new digital landscape we inhabit. Healthcare systems in place require advance digital literacies, yet many individuals lack a basic understanding of how to improve their literacies (digital, media, health, critical thinking, etc.). Compounding issues have arisen as a result of illiteracy and subsequent exacerbated inequities (e.g., mis/disinformation, the Loneliness Epidemic, challenges navigating healthcare systems). These issues threaten to destabilize core societal functions of institutions and social systems. Building on prior frameworks that connect digital literacies and eHealth, the research will build out a comprehensive framework conceptualizing new connections relevant to the modern digital age. An updated version of the eHealth Lily Model, a comprehensive, multifaceted overview of multiple literacies, will be developed under the guidance of experts in digital health literacy and epidemiology. A synthesis of the literature will lead to the creation of an adapted model that includes important concepts such as inclusion, equity, & accessibility. Next, a focus group of experts will be established via mentor-guided purposive sampling and their feedback will be used to make improvements throughout each iteration of the model. The resulting expanded framework will demonstrate to researchers and experts of all fields the role that literacy plays in our growing understanding of how to address these challenges. In the process, this research may improve interventions, encourage educational efforts, and empower citizens with the literacy skills they need to resolve problems.

Keywords: misinformation, collective behavior, literacy, infodemic, eHealth literacy, collective adaptation, health literacy

Shayan Khan

1) Economics 2) Mathematics 3) Arabic at University of Arizona

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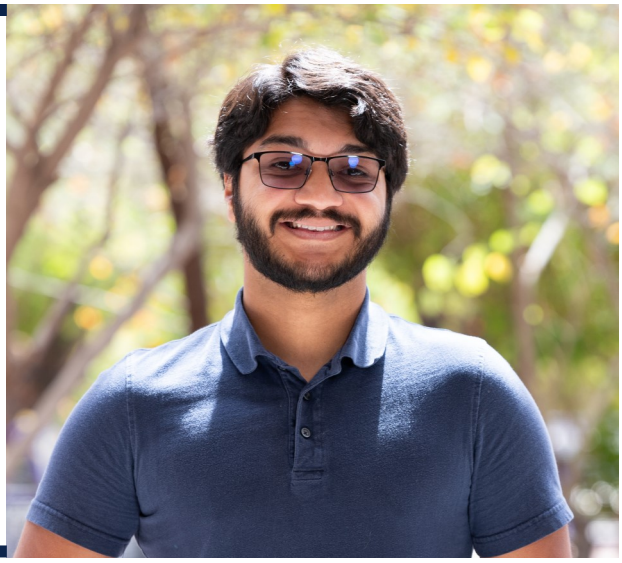

Empathy Education vs. Corruption: Insights from the Lab

Methods of fighting bureaucratic corruption are extremely limited in scope and rely on immense funding. An unexplored technique to combat corruption is the moral education of values like empathy among bureaucrats themselves. In this study, we aim to assess if empathy education affects corruption. Corruption is modeled using a one-shot bribery game based on Cameron et al. (2009) where it will be played at the Economic Science Laboratory with university student participants. The treatment groups are educated on empathy with short videos encouraging them to consider how others would feel and be affected when confronted with an opportunity to engage in immoral behavior. The intervention's effectiveness is measured through multivariate regressions and two-sample t-tests between the control group and treatment groups. We hypothesize that the treatment will successfully decrease the incidence of bribery under the empathy-altruism hypothesis. If the experiments prove successful, this study provides a novel framework of a new anti-corruption technique wherein future studies can observe the effectiveness of this intervention in real-world settings.

Keywords: corruption, empathy, empathy education, anti-corruption, economic experiment, experimental economics, empathy-altruism hypothesis

Octreyvian Killian

1) Literacy, Learning, and Leadership 2) Philosophy 3) German Studies at University of Arizona

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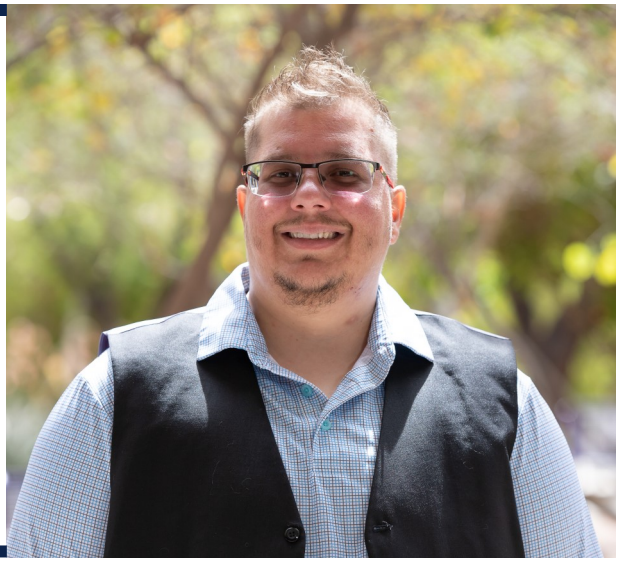

Purpose and Persistence: A Phenomenological Account of Transfer Student Needs

The promise of attending college is that you can work your way to a degree and career with a livable wage, but for many students, this promise goes unfulfilled. Specifically, Transfer Students, on average, take longer to graduate and graduate less often than their peers who started their educational career at the university they will graduate from (Fixed Students). While there is a healthy amount of research on the causes of these discrepancies, most research approaches this failure as the fault of the student, the institution, or circumstances. This study takes an ecological look at the relationship between these bodies and analyzes how each contributes to encouraging and discouraging student development of Purpose and commitment to that commitment. In this qualitative study, students from Transfer and Fixed cohorts are interviewed with open-ended questions to understand differences in their experiences, Purpose, and coping strategies, which are then coded into ecological systems, parties involved, and whether they positively or negatively impact the growth of Purpose. Preliminary results have indicated that Transfer Students experience challenges with funding, sub-par advising, and need help to build meaningful relationships with mentors and/or peers. These findings suggest that universities should: build better programs for mentorship for transfer students, improve the guidance of transfer students by advisors, and develop an open line of communication with students to ensure they are providing for the needs of the current cohort.

Keywords: Transfer Students, Success Metrics, Graduation, Ecology, Purpose, Stages of Change, Coping Strategies.

Katherine Rosenzweig

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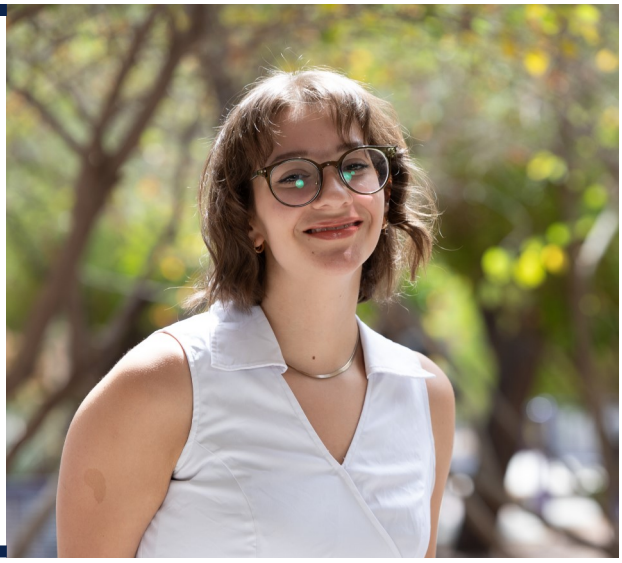

Examining the Contribution of Sleep Architecture to the Executive Function of Adolescents with Type 1 Diabetes

Type 1 diabetes mellitus (T1DM) is a condition requiring daily behavioral management. Executive function (EF) abilities, such as problem solving, behavioral control, and attention, underlie such essential management practices in adolescents. Adolescents with T1DM have been found to have less deep sleep and spend less time in slow wave sleep (SWS) than those without diabetes. Non-restorative sleep has been implicated in deficits in EF. One notable gap in the existing research on this population is the role of sleep architecture as a modifier of EF. The current investigation utilized secondary data analysis from a larger parent study (Family Routines Enhancing Adolescent Diabetes by Optimizing Management, n=100; 57% male, 50% Latine) to examine the relationship between sleep architecture and EF in adolescents with T1DM. It was hypothesized that SWS and REM would be the strongest predictors of adequate EF, as assessed via parent report of the Behavior Assessment System for Children(BASC). Contrary to expectations, rather than deeper sleep predicting better EF skills, lighter sleep (stage N1) related to poor EF skills in the domains of hyperactivity, emotional control, and behavioral control. Additionally, the hypothesis was partially supported as results indicated that the low-risk executive dysfunction group(BASC T-score<60) had a significantly higher percentage of REM, but also a lower percentage of Stage 1 (light sleep) than the at-risk group (BASC T-score>60). These findings suggest a potentially modifiable behavioral intervention target to improve cognition and disease management.

Keywords: Adolescents, Type 1 diabetes mellitus, Executive function, Sleep Architecture

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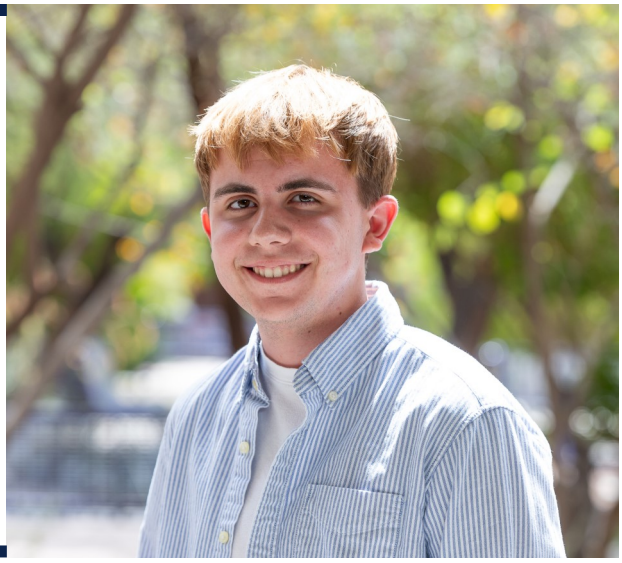

Unpacking the 'wrong body' myth: A critical analysis of transgender representation in children's books and its educational implications

The broadly established formula that institutions follow to make elementary education safer, more inclusive, and more supportive for queer and trans students is increased access to diverse representation. However, a minimal body of research investigates the nuance of this formula: How does content with LGBTQ+ representation continue to perpetuate boundaries around how children can be in the world? This study examines how children's literature, even when featuring transgender characters, can subtly reinforce narratives that inscribe a one-way medicalized and linear transition across the gender binary in which transition equates to changing a 'wrong' body into a 'right' body. Specifically, this research focuses on the pervasive 'born in the wrong body' narrative and its three themes: gender essentialism, gender binarism, and moving from one fixed destination to another – the dominant means of describing and understanding trans, transgender, and transsexual stories. By conducting critical content analysis of five commonly recommended books for elementary-aged children with transgender protagonists or narrators, this study investigates how these books either perpetuate or challenge the 'born in the wrong body' narrative. The findings will shed light on the potential of children's literature and education to break down boundaries of beingness and empower youth to live as their authentic selves.

Keywords: gender, transgender studies, early childhood education, born in the wrong body narrative, children's literature, critical content analysis

Gilberto Torres Gomez

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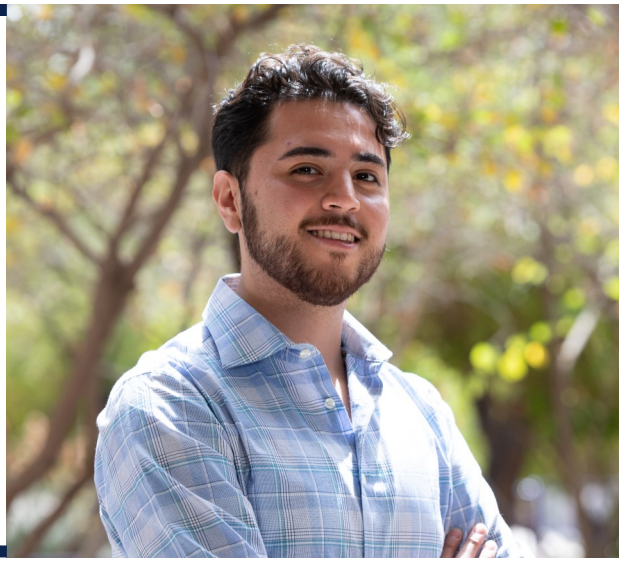


K-12 Special Educator Moral Dilemmas within Southwestern U.S. School Districts.

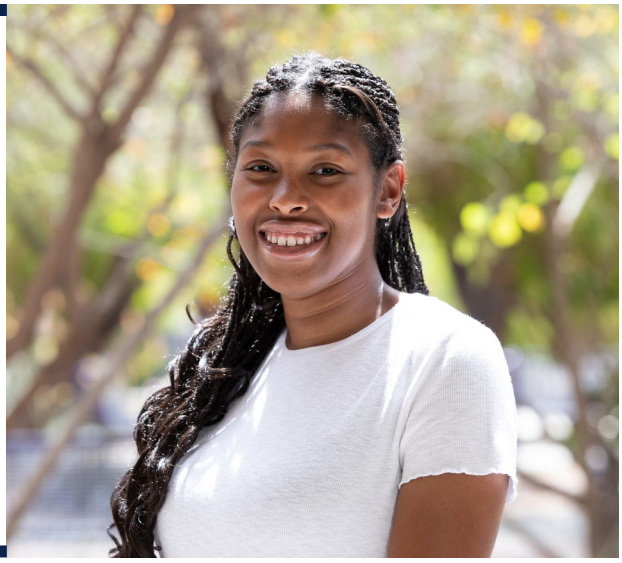
Moral injury (MI) is characterized by psychological trauma that arises when a person behaves in ways, or witness an event, that violates personal moral beliefs. While the extent of MI is widely studied for various groups, including K-12 educators, there isn't much research conducted to understand the types of moral dilemmas (MDs) that K-12 educators experience. The present study focuses on the moral experiences of educators who currently teach, (or have taught), students with disabilities in the Southwestern U.S. Participants of this study will be taking a survey that consists of three separate measures: the Rushton Moral Resilience Scale (RMRS-16), the Expressions of Moral Injury Scale – Civilian (EMIS-C), and the Moral Dilemmas Content Measure (MDCM) which was developed for the purposes of this study. The RMRS-16 measures levels of moral resilience (MR) in participants, while the EMIS-C will measure levels of MI. By better understanding the types of MDs encountered by teachers, we can pinpoint deficiencies in the structure and operations of U.S. schools. Given that certain U.S. states within the southwest often rank low in academic categories, educators that work within this region might be experiencing extensive boundaries towards providing meaningful learning experiences for students with disabilities. These boundaries often involve MDs related to students with disabilities, and the subsequent choices of teachers. By examining MDs, we also adopt a more wholistic view of the boundaries that exist against optimal learning environments for students with disabilities.

Key words: K-12 educators, education, special education, moral dilemmas, moral injury disability studies.

Jazzmine Ward

Psychological Science at University of Arizona

Mentored by Ashley Huggins, PhD (Psychology)



Understanding How Childhood Trauma Shapes Psychological Well-being and Influences Educational Attainment: A Neuroimaging Study Examining Differential Effects of Abuse and Neglect on Volume of Cerebellum

Childhood trauma is well-known to have detrimental effects on psychological well-being and cognition. The cerebellum contributes to both emotional and cognitive function. Thus, investigating how childhood trauma affects this brain region's development may advance our understanding of the biological factors that can impact learning and emotional health across the lifespan. Structural MRI brain scans and retrospective self-reports of childhood trauma were collected from a sample of adults. Cerebellum volumes were derived from an automated segmentation software (ACAPULCO). Trauma severity during childhood was assessed using the Childhood Trauma Questionnaire, with subscales to separate into either threat or deprivation trauma types. A linear regression was performed to examine whether childhood trauma severity predicts adult cerebellum volumes, accounting for age and gender. Notably, threat severity - but not deprivation - during childhood was associated with smaller cerebellum volumes in adulthood. These findings suggest that abusive experiences during childhood might have more consequential impacts on neural development. Throughout the remainder of 2024, quality control checks of the cerebellum scans will be conducted to ensure the variety of these results. In ongoing analyses, this study also aims to understand how cerebellum volume relates to cognitive function. To address this aim, we will conduct a series of correlations to examine associations between cerebellum volume and hypothesize that smaller cerebellum volume will be associated with poorer cognitive performance. The findings of this study will illuminate how childhood adversity can impact cerebellum development and have functional consequences on cognitive and emotional wellness that affect students' learning and achievement into adulthood.

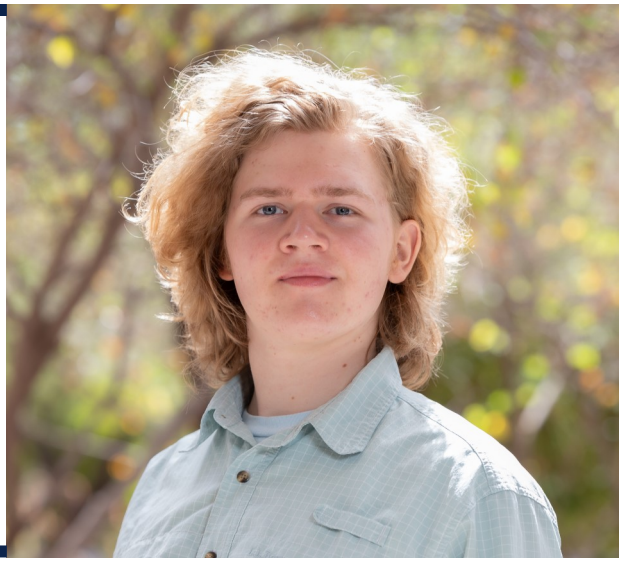
Biosphere 2:
Research for Environmental Solutions (B2 REU)

PI: Katerina Dontsova, PhD
Co-PI: Kevin Bonine, PhD
Sponsors: National Science Foundation Research Experiences for Undergraduates (NSF REU) Program and University of Arizona Graduate College

Oskar Peter Anderson

Natural Resources at University of Arizona

Mentored by Scott Saleska, PhD, Peter Troch PhD, Wei-Ren Ng, and Matej Durcik PhD (Ecology & Evolutionary Biology)



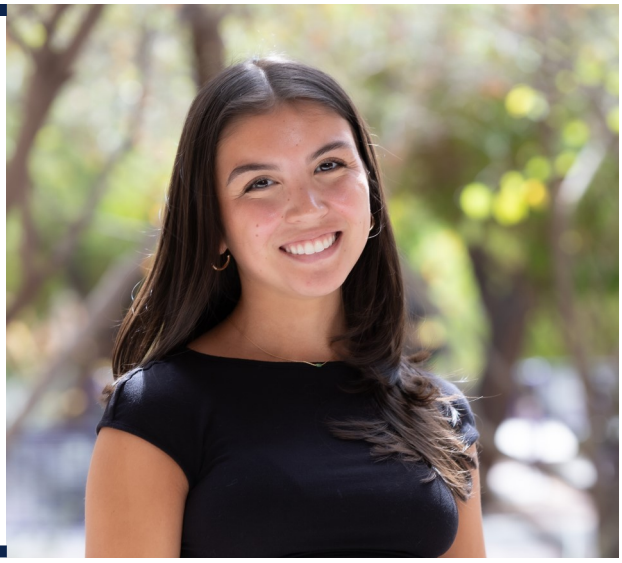
Ground Cover Type and Rainfall Affect Critical Zone Carbon Dioxide Flux

Understanding the fluctuation of carbon dioxide gas in early developing ecosystems is critical to gaining a richer understanding of the carbon cycle and how it changes with the landscape. Past studies at the Biosphere 2 measured these fluxes throughout different stages of ecological succession, and we continued this work into the most recent developments. In our work, we chose to compare carbon dioxide flux between three different land cover types: bare basalt soil, cyanobacterial crust, and crust-moss combination. Our research took place on the Landscape Evolution Observatory (LEO) west hillslope, a unique indoor experimental environment in which we sampled at different times following rainfall events. Using a trace gas analyzer, we measured a timeseries of fluxes across the three land covers and three positions along the slope for a balanced design (3 cover types x 3 slope positions x 3 replicates). Previous studies when the soil was not biotically colonized showed a notable uptake of carbon dioxide by the basalt, whereas recent measurements suggested biological respiration outpacing photosynthesis across all land cover types. Our data partially supports this, with days further from rainfall especially demonstrating a net exhalation of carbon dioxide from the surface. A surprising change came with our measurements on wet soil, which showed a notable afternoon carbon dioxide uptake by only the crust and bare soils. This shines some light on the carbon cycle's shifting role throughout various stages of life and encourages further research analyzing how a landscape and its processes change with the seasons.

Kiara Barlet

Chemistry at University of West Florida

Mentored by Clément Lopez-Canfin, PhD and Katerina Dontsova, PhD (Biosphere 2)



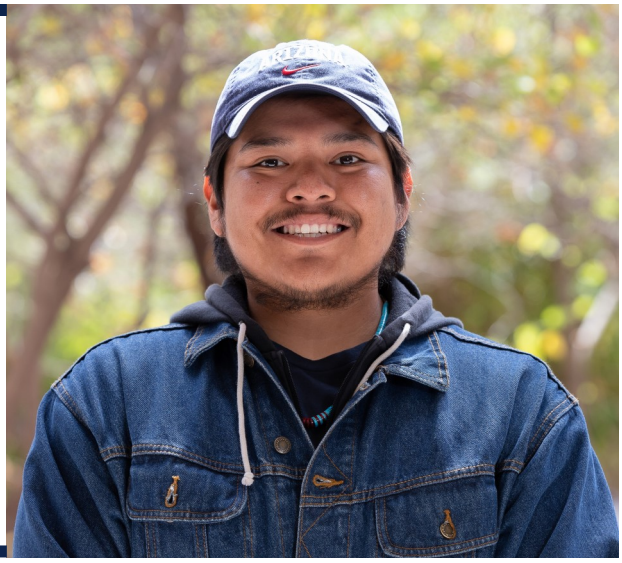
Spatial Variability of Soil Specific Surface Area and Clay Fraction in Drylands

Carbon dioxide sequestration in drylands through adsorption on soil particles can aid in mitigating climate change. This process is directly proportional to soil specific surface area (SSA) which is dependent on the soil's clay content. However, the spatial variability of these parameters is not well known, especially in drylands where soil cover is highly heterogeneous. A psychrometric method based on the adsorption of water vapor on soil particles has been proven to be efficient in estimating SSA in many soil varieties, but evidence of reliability of this method in clay-rich soils is limited. Here, this method was used to assess the spatial variability of SSA of clay-rich dryland soils by comparing samples collected in 'fertile islands' (under biological crusts) and in bare soil. We assumed that the psychrometric method could be optimized by taking advantage of the soil residual water content and that SSA would be greater in fertile islands. Taking advantage of the residual soil water content did not improve SSA estimation as the best correlation between the SSA and the clay content was found with the traditional approach (R^2= 0.88), confirming reliability for SSAs ranging from 5 to 600 m^2/g (25 to 96 m^2/g in this study). Contrary to our expectation, fertile islands had a lower SSA than bare soil (but more variable). Further research is needed to confirm and explain this pattern.

Cauy Bia

B.S. of Agriculture/ M.S. of Biology at Diné College

Mentored by Joost van Haren, PhD (Environmental Science)



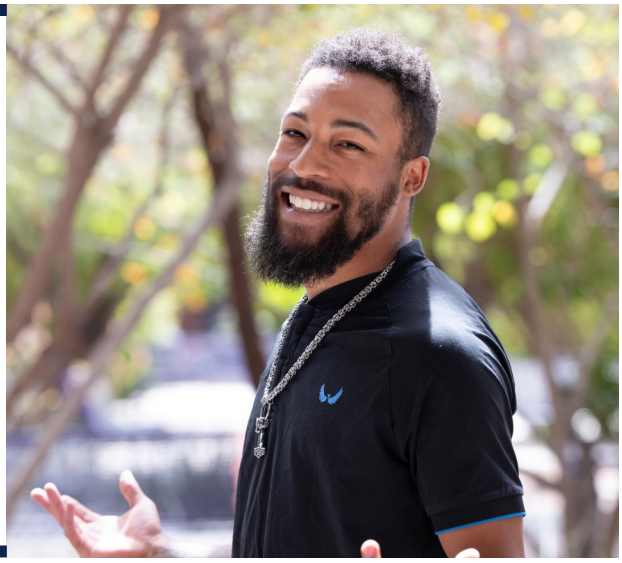
Responses of Cacao Tree Carbon Cycling to Light Exposure and Temperature

In the summer of 2024, a comprehensive study was conducted to analyze the growth, gas exchange rates, and photosynthetic rates of cocoa trees, under varying light exposures and temperatures. The research aimed to identify optimal light conditions and temperatures that enhance cocoa tree productivity and overall health. Cocoa leaves were sampled with a Li-Cor 6800 paired with a fluorometer. This instrument measured the gas exchanges and the chlorophyll fluorescence over the same leaf area. Over a three-week period, eight trees were selected across three elevation levels, two branches were measured per tree. Vegetative assessments were conducted at each branch site, branch diameter, branch length, and leaf count were recorded. In addition to the measurements, branches were harvested at each tree, to measure and identify the bulk density. The results presented a significant variation in growth and photosynthetic performances across the different light and temperature treatments. Cocoa trees exposed to partial shade exhibited the highest growth rates and photosynthetic efficiency, while those in full sunlight and deep shade showed signs of stress and reduced growth.

D-von Bridgeforth

Chemistry at University of Arizona

Mentored by Craig Ramussen, PhD and Adela Maria Alignay Reynoso (Environmental Science)



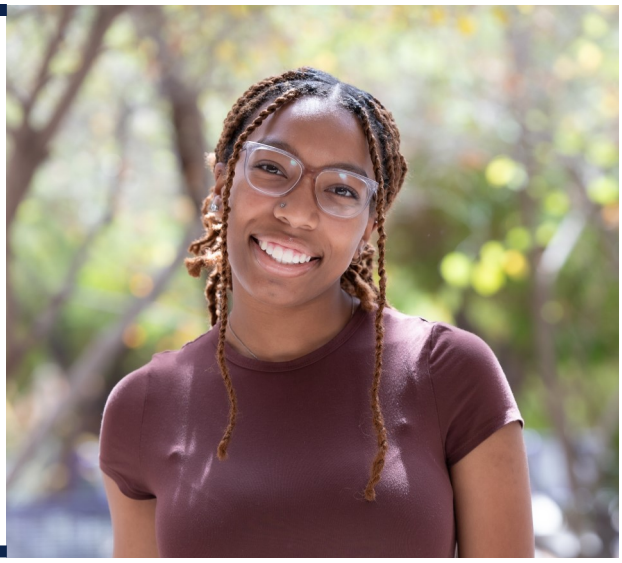
METHODS FOR SILICON ANALYSIS IN SOIL, PLANT AND FERTILIZERS

To develop recommendations for field applications of silicate materials, knowledge of the soil Si status and the availability of Si in the amendment are essential. To determine a crops response to application of Si requires calibration of soil Si status and plant uptake. While a method for determining plant Si levels using the autoclave induced digestion procedure (Elliott and Snyder,1991) is well established, the challenge for routine testing of soils and amendment materials is the development of simple, dependable and robust methods that correlate well with changes in soil Si status and corresponding plant tissue levels. The total Si content of soils can have little relationship to the concentration of soluble Si in soils, which is the component important for plant growth. The concentration of soluble Si is dynamic, and although leaching of Si from the soil and plant uptake are important processes determining Si concentrations, the equilibrium concentration is largely controlled by adsorption/desorption reactions. A few chemical extraction procedures have been developed to determine the ‘plant available’ soil Si status, and a range of these are compared when used on different soil types.

Giselle Campbell

Industrial Engineering at
Pennsylvania State University

Mentored by Katerina Dontsova, PhD, Favianna Cubello, and Matthew Peterson (Environmental Science)



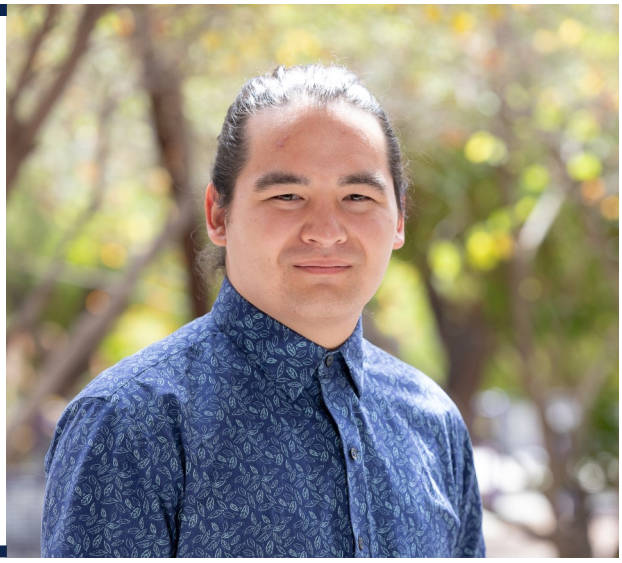
Carbon and Nitrogen Concentrations in LEO Basalt Hillslopes

The Landscape Evolution Observatory (LEO), investigates important processes in soil development, including hydrology, erosion, and carbon accumulation. Natural hillslope formation and development occur over long geological timescales, making real-time study of primary stages challenging. Additionally, changes in vegetation, climate, and land usage in natural environments can obscure these developmental changes, complicating consistent and controlled studies. LEO addresses these challenges with a large-scale, controlled hillslope experiment. These model hillslopes, composed of basalt, allow for its development to be observed from its initial state, due to basalt's homogenous features and pure mineral formation. This enables comprehensive analysis of carbon and nitrogen concentrations during key soil processes, such as weathering and biological activity. Total carbon (TC) and total nitrogen (TN) in soil samples were analyzed in triplicate by combustion at 900°C using Shimadzu SSM-5000A with a TOC-L and TNM module. This study reveals that carbon and nitrogen accumulation in basalt varies with the location and depth of the sample. This is likely due to runoff and biological activity being unevenly distributed across the hillslope. Runoff typically transports nutrients from the upper region of the hillslopes towards the lower regions, leading to higher concentrations of carbon and nitrogen downslope, positively influencing biological activity. The presence of moss and biocrusts on the hillslopes leads to an increase in carbon sequestration, due to photosynthesis. This study enhances our understanding of carbon sequestration and nitrogen accumulation during early soil development, providing valuable information into the processes that influence soil health and climate change.

Connor Fenn

Biology at Cochise College

Mentored by Diane Thompson, PhD, Lia Crocker, and Renee Grambihler (Geosciences)



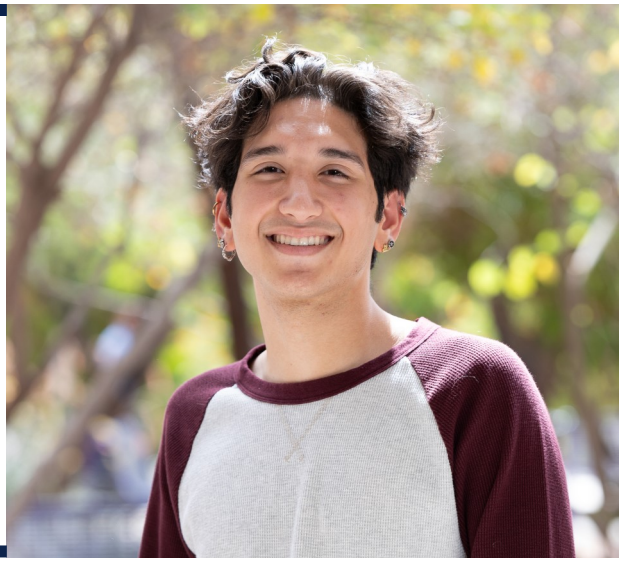
How Will Supplemental Lighting Treatments Impact the Calcification and Color of Corals

Coral reefs are critical habitats for biodiversity and coastal erosion control. Due to climate change, half our reefs worldwide have been lost, and will continue to lose more. The Biosphere 2 Ocean is an ideal testing ground for more radical approaches to conservation because of its scale and control. However, there are pitfalls with Biosphere 2 replicating coral lighting needs. Supplementing the lighting is a solution to mask these shortcomings. Corals respond differently under various lighting treatments, with less bleaching and calcification under treatments specialized to shorter wavelengths, and will bleach and calcify more under general wavelength treatments. Using three species of corals (*Montastraea cavernosa*, *Orbicella faveolata*, and *Pseudodiploria clivosa*) and the Mini-Ocean and Coral Raceway tanks at the Biosphere 2, we tested the tissue growth, calcification, and color change of coral fragments under different lighting treatments at Biosphere 2. The two lighting treatments were a generalized treatment of purple, blue, and red and a specified treatment of purple, blue, and cyan. We found the corals lost blue and green at a significant rate during the treatments. Contextual data from our study found temperatures in the Mini-Ocean were over the preferred ranges of corals during the trials. Future studies on the topic at Biosphere 2 should standardize temperature and other water quality in the ocean if it isn't a variable under study.

Andrew Hernandez

Environmental Science at
Northern Arizona University

Mentored by Joost van Haren, PhD (W.A. Franke Honors College)



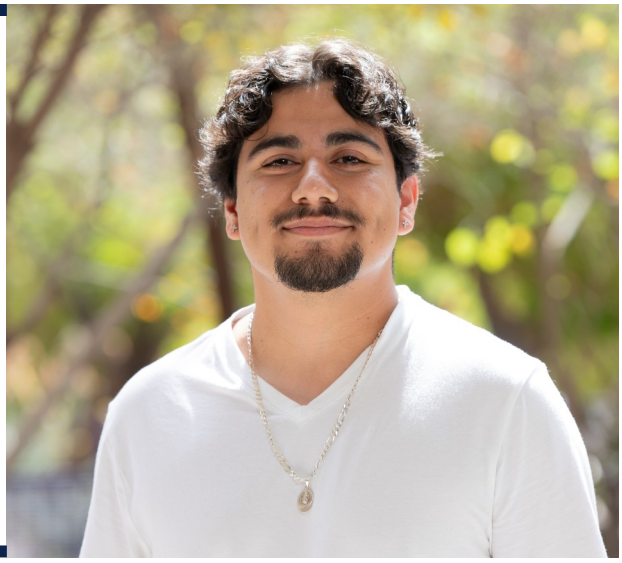
Temperature Acclimation of Six Tropical Tree Species in the Biosphere 2 Tropical Forest

As the changing climate is expected to raise temperatures globally, the purpose of this study is to see how tropical rainforest tree leaves adapt to different temperatures. Biosphere 2's tropical rainforest, a controlled ecosystem facility, holds five different temperature zones, separated by height; top ++, top +, top, mid, and low. The highest zone is the hottest (top ++), while the lowest zone is the coolest (low). Under these five temperature zones, six tropical tree species were tested: Pachira aquatica, Coffea arabica, Piper auritum., Clitoria fairchildiana, Theobroma cacao, and Annona muricata, under these different temperature levels. Micro-Pulse Amplitude Modulated (Micro-PAM) sensors measured photosynthetic active radiation (PAR), temperature, non-photochemical quenching (NPQ), vapor pressure deficit (VPD), electron transport rate (ETR), and quantum yield of photosystem II (Y(II)) on leaves at different temperature levels. Sensors were rotated among each leaf species every three to four days, and data were analyzed using the WinControl program. Leaf was collected after data collection. Leaf samples were weighed wet and dry, their areas measured, in order to determine leaf water content (LWC) and leaf mass area (LMA). As a result of increasing temperature and PAR, each leaf's NPQ also increased. Although increasing temperatures may lower Y(II), there was no long-term damage seen, due to each leaf species being able to bounce back the next day. Leaves with higher LWC aren't as affected by higher temperatures than leaves with lower LWC. Having higher temperatures do affect leaf chemistry, but with these temperatures it is not long term.

Austin Martinez

Biology: Ecology and Environmental Science emphasis at
California State University, Dominguez Hills

Mentored by Joseph Hoover, PhD (Environmental Science)



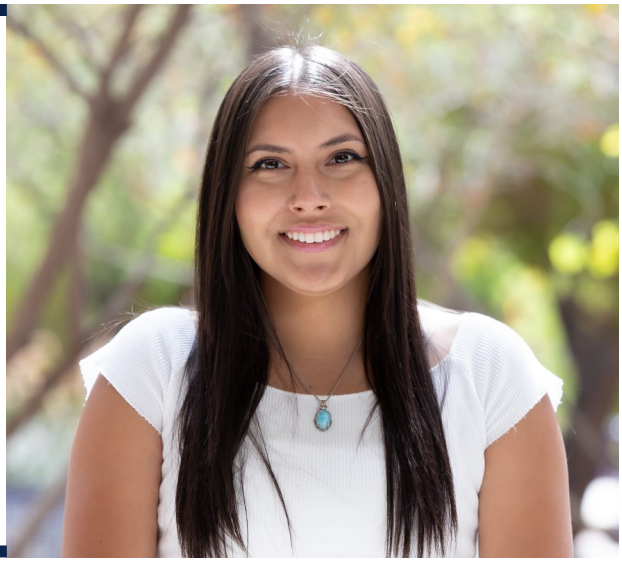
Using Machine Learning and Geospatial Data to Predict Groundwater Occurrence of Arsenic in the Colorado Plateau

The purpose of this study was to predict arsenic groundwater concentrations throughout the Colorado Plateau using machine learning methods. A secondary objective was to identify counties that are at risk of arsenic exposure (defined as As concentrations >10 ug/L). To accomplish this goal we extracted water quality data from the Water Quality Portal, and compiled hydrologic, geologic, and soils geospatial data. Using R (V. 4.4) and ArcGIS Pro (V. 3.3) we compiled a dataset for modeling, and created prediction models for XGBoost, Random Forest Classification, and Boosted Regression Trees. The developed dataset, balanced by arsenic occurrence categories (C1 = 0-5 ug/L, C2 = 5.1-9.9 ug/L, C3 > 10 ug/L), was split into training (70%) and testing (30%) sets. Model performance was optimized using 10-fold cross-validation on the UArizona Puma Supercomputing Cluster. Results indicated that Random Forest Classification achieved the highest testing data accuracy at 91.3%, while XGBoost showed the highest training data accuracy at 82.6%. Among the models, Elevation, Precipitation, Calcite, and Koalinit variables demonstrated high importance. Spatial analysis of the testing data indicated potential for arsenic exposure for communities located in New Mexico (Sandoval, Cibola), Arizona (Navajo, Mohave, Coconino), Utah (Washington, Iron) and Colorado (San Miguel, and Montrose). Next steps in this work include additional hyperparameter tuning, addressing incomplete observations in the dataset (e.g., missing observations for location elevation or well depth), and further reflecting on the variable importance results from these models.

Andrea Carolina Ochoa

Hydrology and Atmospheric Sciences: Water Resources emphasis at University of Arizona

Mentored by Peter A. Troch, PhD, Scott Saleska, Wei-Ren Ng, Matej Durcik, Aaron Bugaj, Rhiannon Nabours, and Ankit Garg
(Hydrology & Atmospheric Sciences)



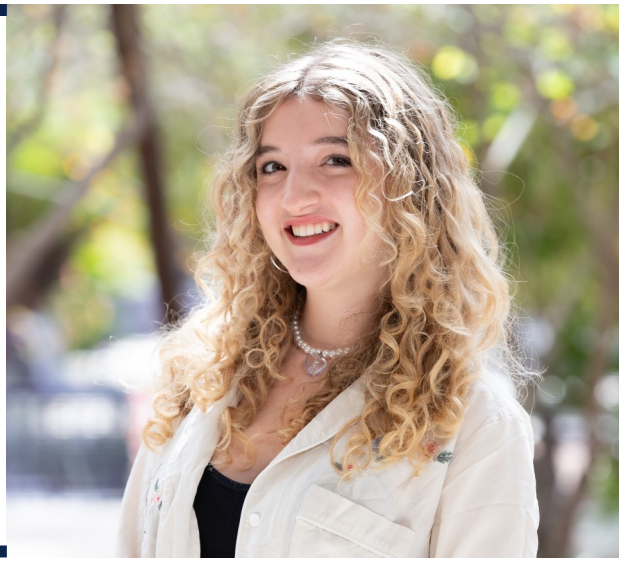
Effect of Land Cover Types on Evaporation Rates under Different Wetness Conditions and Slope Positions at LEO (Landscape Evolution Observatory) West hillslope

This research aims to determine how land cover types (bare basalt soil, biocrusts, and moss mixtures) on LEO's (Landscape Evolution Observatory) West hillslope affect evaporation rates under varying wetness conditions (days since last rain) and slope positions. We hypothesize that evaporation fluxes will be higher towards the bottom of the slope following rain events, with bare soil exhibiting higher rates due to lower water vapor flux resistance compared to crust-covered areas, and minimal influence from dormant mosses. We tested this hypothesis using the LEO West hillslope at Biosphere 2 during the summer of 2024. The study was conducted on a 30m x 11m hillslope. We used a LI-COR LI-7810 trace gas analyzer, flux chamber, and thermal IR camera (ICI 9640P) to measure evaporation rates and surface temperatures across 27 locations (3 land cover types, 3 hillslope positions, and 3 replications) during each sampling period. Sampling occurred biweekly over three 24-hour periods (wet, damp, and dry days) and three sampling times (early morning, mid-day, and late night), with rain events scheduled prior to each sequence. Preliminary results show higher evaporation rates in moss mixtures, especially towards the bottom of the slope after rain events, and both up and down the slope when damp. On the driest day, negligible effects were observed for both land cover type and slope position comparisons. These findings highlight the importance of land cover and slope position in evaporation dynamics, contributing to our understanding of hydrological processes in arid environments.

Helene Saleska

1) Biology 2) Political Science at McGill University

Mentored by Malak Tfaily, PhD and Ghiwa Makke (Environmental Science)



Temperature-Driven Metabolic Adaptation in Sonoran Desert Bacteria: Phenol Production and Ecological Implications

Microbiomes are crucial to ecosystem dynamics, yet their response to environmental changes remains poorly understood. This study investigates the metabolic plasticity of *Arthrobacter nitrophenolicus*, a Sonoran Desert bacterium, in response to temperature variations. Previous multi-omics investigations via metagenomics and metatranscriptomics revealed functional differences across moisture gradients, with distinct metabolic processes observed during hotter drier months. We hypothesized that *A. nitrophenolicus* adapts its metabolism in response to temperature and moisture changes, potentially impacting soil ecosystem processes. To test this, we cultured *A. nitrophenolicus* at 35 degrees celsius and 20 degrees celsius (room temperature) and analyzed its metabolomic profile. We sought to determine if temperature is the leading variable of this change. Our results revealed temperature-dependent metabolic pathway shifts. At 35 degrees, bacteria exhibited higher metabolite diversity, increased phenol production, and greater sugar and protein utilization. At 20 degrees, lipid production was elevated. This suggests that *A. nitrophenolicus* adapted to the hot desert environment by increasing phenol production at higher temperatures as a mechanism to mitigate oxidative stress. This temperature-dependent metabolic shift aids in the bacterium's survival and may also significantly influence microbial interactions within the soil ecosystem. Phenolic compounds possess antimicrobial properties, which could alter soil microbial community dynamics. This study has important implications for understanding microbial adaptations to extreme environments and their cascading effects on ecosystem function. Future research should investigate specific roles of these phenolic compounds in oxidative stress management, their impacts on microbial diversity and soil health, and how these adaptations might evolve under ongoing climate change scenarios.

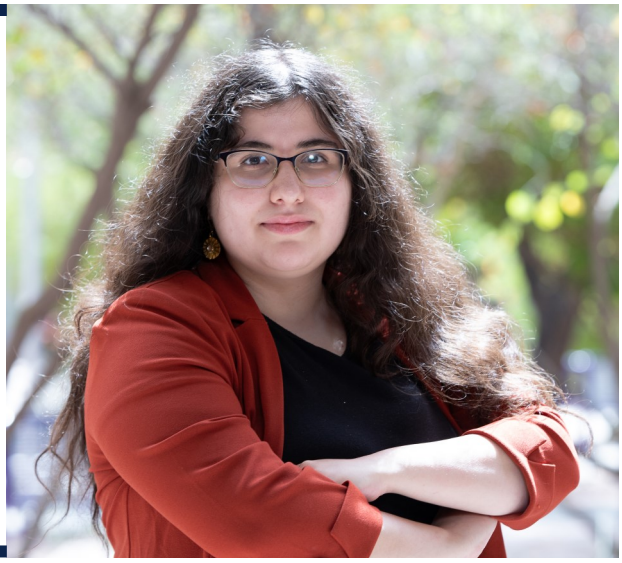
Maximizing Access to Research Careers (MARC)

PI/Director: Katrina Miranda, PhD
Co-Director: Sam Campos, PhD
Assistant Director: Cindy Neal, MEd
Sponsors: National Institute of General Medical Sciences of the National Institutes of Health (NIGMS-NIH)

Leili Asgharzadeh Falbinan

Biomedical Engineering at University of Arizona

Mentored by Beth Hutchinson, PhD and Laurel Dieckhaus (Biomedical Engineering)



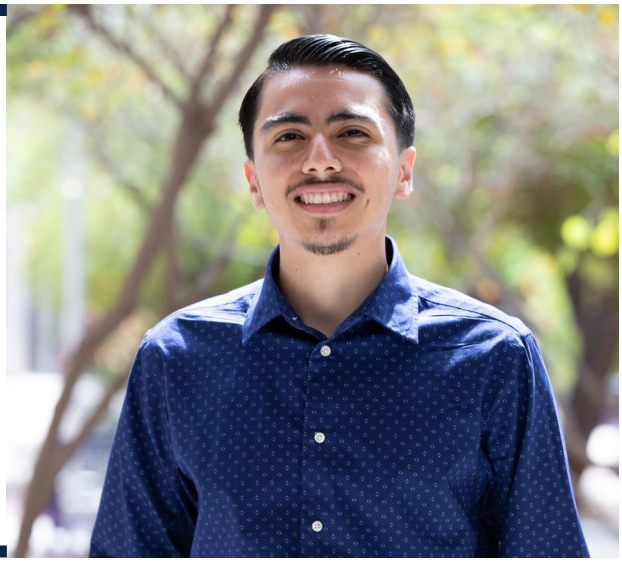
Identifying Age-Related Changes in In-Vivo Ferret Brains Through Diffusion MRI and Morphometry

Analyzing age-related changes in the brain is crucial for understanding the mechanisms of cognitive decline and developing effective treatments. This study investigates these changes, particularly in cognitive regions, using in-vivo ferret models that offer brain complexity similar to humans. The ferrets' gyrification and brain structure provide a valuable model for longitudinal studies, allowing for detailed analysis across multiple timepoints. Our objective was to observe differences in white matter and morphological changes, including growth or shrinkage, across the whole brain. To quantify local differences in brain anatomy, we employed tensor-based morphometry by warping each ferret's second session image to their first session image, thus enabling measurement of volumetric changes across the brain. For analysis, we generated several diffusion MRI derived maps, including Fractional Anisotropy (FA), Diffusion Tensor (DT), and Axial Diffusivity (AD) maps. These maps reveal metrics of white matter integrity, such as demyelination, and visualize white matter tracts. We then compared FA maps from the initial baseline scan to the second session using subtraction maps to evaluate specific regions where white matter may have decreased. This approach provides insight into the progression of white matter changes over time. By understanding these changes in ferrets, we aim to apply similar methodologies to human studies, enhancing our comprehension of age-related brain changes and contributing to the development of interventions for neurodegenerative diseases.

Marc Garcia

1) Biochemistry 2) Molecular & Cellular Biology at University of Arizona

Mentored by Joyce Schroeder, PhD and Ryan Hecksel (Molecular & Cellular Biology)



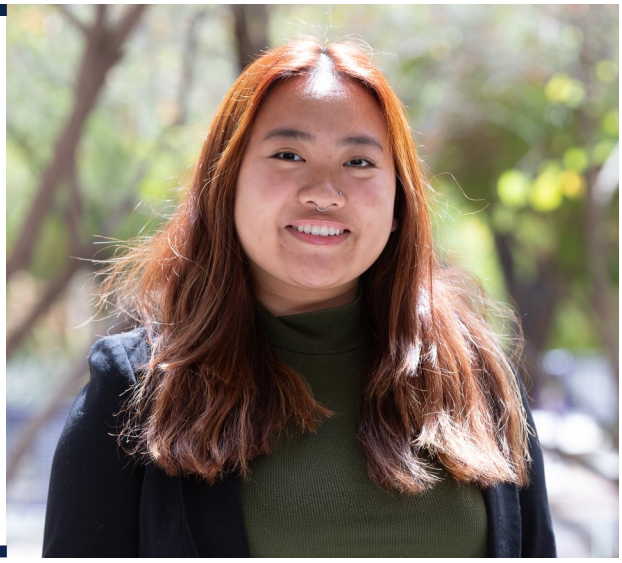
Mutations in the Nuclear Export Sequence of EGFR Influences Cell Proliferation and Morphology

The epidermal growth factor receptor (EGFR) is known to play a role in several cellular functions such as proliferation, survival, and migration. It is often overexpressed in triple-negative breast cancer, making it a promising druggable target. EGFR can enter and exit the nucleus via the nuclear localization and export sequences (NLS/NES). Once inside, EGFR interacts with transcription factors to regulate pro-oncogenic genes. A peptide drug named cSNX1.3, developed in the Schroeder lab, reduces tumor size in mice and blocks nuclear EGFR in vitro and in vivo. As a result, we hypothesize that using CRISPR/Cas9 to create a mutation in the NES will prevent EGFR from leaving the nucleus and therefore modify cellular activity. We explored cell viability, proliferation, and morphology within multiple cell lines using MTT assays, live cell imaging, and Matrigel cultures. Combing our data allowed us to discover that cells with the NES mutation had an overall decreased rate of growth, while also showing impacted cell viability when treated with cSNX1.3. The Matrigel experiments revealed that the 468 and 231 cell lines became more “mesenchymal-like” rather than epithelial which could account for the decreased growth rate seen in our live cell imaging. Future research will focus on mutating the NLS of EGFR to determine its impact on cellular phenotypes, identifying genes regulated by nuclear EGFR, and examining the effects of NES mutations in non-transformed cell lines. This work will enhance our understanding of the nuclear functions of EGFR across various cell types.

Riley Haveman

Pharmaceutical Sciences at University of Arizona

Mentored by Todd Vanderah, PhD, and Kelly Karlage (Pharmacology)



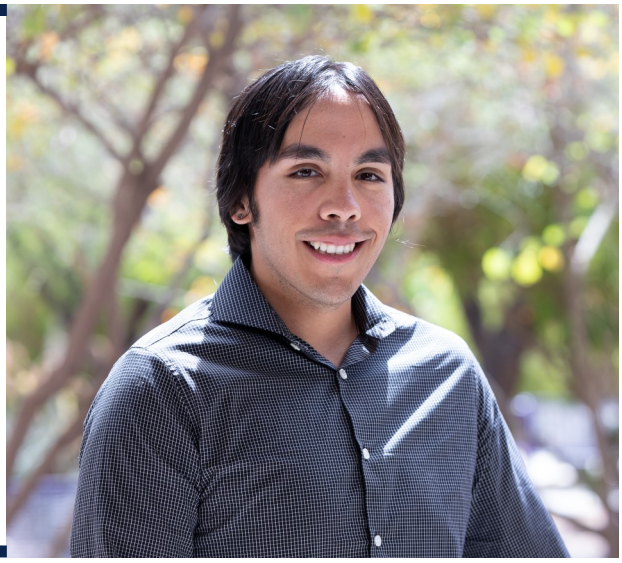
Does Inhibiting ABHD6 in Male Mice Mitigate Pain and Depressive Behaviors?

According to recent studies, up to 17% of the general population struggles with neuropathic pain. Looking to the endocannabinoid system as a source for treatment, this study examines the effect of the compound KT-182, an irreversible ABHD6 inhibitor. ABHD6 is an enzyme that breaks down the endocannabinoid 2-arachidonoylglycerol (2-AG), thus through inhibition of its activity, 2-AG levels increase. KT-182 has successfully mitigated pain in a medication overuse headache model, but has not been examined in a neuropathic pain model, such as partial sciatic nerve ligation (pSNL). This study seeks to better understand whether KT-182 is able to diminish chronic neuropathic pain and resulting depressive behaviors. In order to model neuropathic pain, male mice undergo the pSNL surgery on their right sciatic nerve. Using behavioral assays, such as Von Frey and Forced Swim to assess allodynia and depressive behaviors respectively, data is then collected on the development of each behavior. Throughout the study, mice are separated into a KT-182 and a control group in order to determine the success of the compound. The findings of this pilot study suggest that KT-182 is able to lessen pain responses in the mice, but has decreased effectiveness when being dosed chronically. Moreover, the data shows that the compound has no significant effect in preventing or reversing depressive behaviors. In the future, more studies with a larger sample size will be conducted to continue exploring the positive effects of KT-182 on pain behaviors and possible effects on depressive behaviors.

Dylan Hermosillo

Bioinformatics at University of Arizona

Mentored by Bonnie Hurwitz, PhD (Biosystems Engineering)



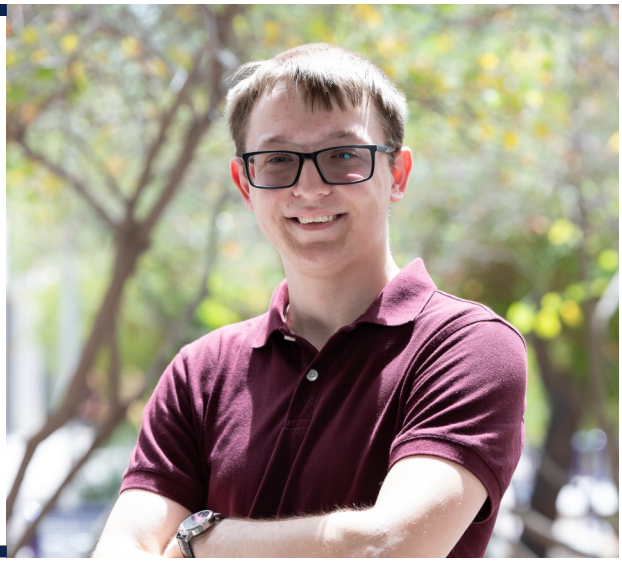
Lipidomic compositional analysis of artherosclerotic plaque in type-2 diabetes patients.

Cardiovascular disease is the leading cause of death among individuals with diabetes, accounting for two-thirds of the reported fatalities. Atherosclerosis, characterized by the buildup of fatty plaque on the artery walls, obstructs blood flow and can rupture, leading to the formation of blood clots. Specific lipid species may influence the severity of arterial plaque accumulation. Our study aims to identify, characterize, and compare lipid compositions among symptomatic and asymptomatic diabetic, non-diabetic, and prediabetic patients to determine if significant lipid species emerge as potential biomarkers for future prognostic analysis. We analyzed lipids using liquid chromatography-mass spectrometry (LC-MS) from 71 surgically removed endarterectomy specimens from the following groups: diabetic asymptomatic (n=11), diabetic symptomatic (n=9), non-diabetic symptomatic (n=12), non-diabetic symptomatic (n=20), prediabetic asymptomatic (n=9), and prediabetic symptomatic (n=11) patients. The lipid data were cleaned, log2 normalized, and analyzed using P-Mart and MetaboAnalyst statistical tools to identify significant differences in lipid composition and species among the various patient groups. Initial results suggest that glycerophospholipids are significantly more abundant in symptomatic diabetics compared to asymptomatic diabetics and are even more prevalent in symptomatic prediabetics than in either diabetic group. We also find that glycerol lipids are significantly more abundant in symptomatic diabetics compared to asymptomatic diabetics. These results suggest that lipid species could act as important biomarkers in understanding atherosclerosis disease progression in individuals with diabetes.

Caleb Konecek

1) Biochemistry 2) Molecular & Cellular Biology
3) Spanish at University of Arizona

Mentored by Pascale Charest, PhD and Isaiah Toth (Molecular & Cellular Biology)



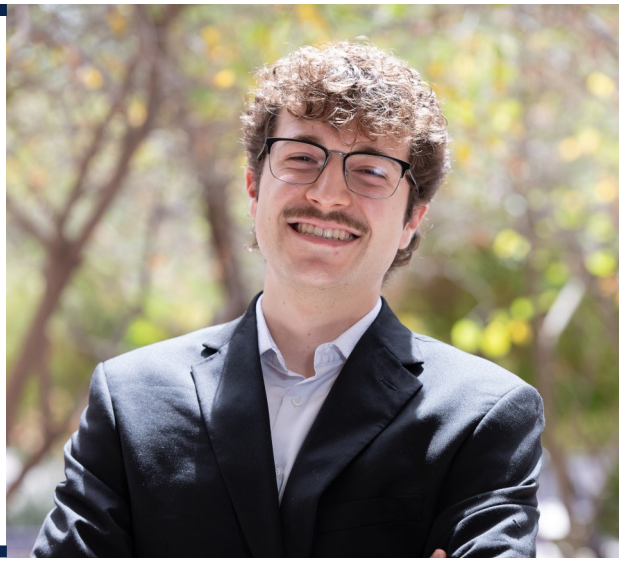
Role of Rap1 versus PIP3 in the Regulation of mTORC2

Chemotaxis is a directed cell migration in response to external chemical stimuli that is critical for biological processes like development and immune response. Chemotaxis dysregulation has been linked to disease spread like cancer metastasis, but its disruption isn't fully understood. Research has shown that the mechanistic Target of Rapamycin Complex 2 (mTORC2) is crucial for chemotaxis regulation and cytoskeleton structural protein rearrangement. Despite mTORC2's implications in chemotaxis, its precise role and regulation are unclear. Recently, we have identified the small GTPase Rap1 as a binding partner of the SIN1 component of mTORC2, and experiments have linked Rap1 overexpression to increased mTORC2 activity in mammalian cells. Additionally, evidence suggests that the membrane phospholipid PI(3,4,5) (PIP3) similarly regulates mTORC2 activity by binding it to the plasma membrane with experiments demonstrating decreased activity following inhibition of PIP3 production. Although Rap1 and PIP3 positively regulate mTORC2, there is a critical gap in understanding their relationship in its regulation and localization to the plasma membrane. Our research attempts to clarify their relationship as binding partners of SIN1 to provide insight into chemotaxis and disease processes. We hypothesize that Rap1 and PIP3 independently regulate mTORC2 activity in HEK293 cells by playing similar roles in its localization. To test this, we over expressed Rap1 and used a PIP3-production inhibitor, examining their effects on mTORC2 activity in HEK293 cells in response to stimulation by insulin, a strong activator of mTORC2. So far, our research shows no significant difference between the effects of Rap1 and PIP3 on mTORC2 activity.

Tyler Martinez

Chemistry at University of Arizona

Mentored by Michael Marty, PhD, Annika Silverberg (Chemistry & Biochemistry)



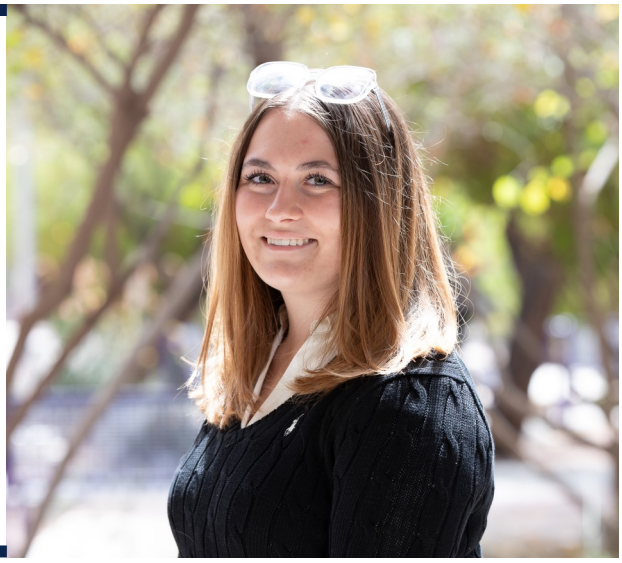
Using Nanodiscs to Study Lipid Exchange

Lipids are known to modulate membrane protein structures and functions. To study lipid binding affinity to different membrane proteins, nanodiscs, a membrane mimetic, can undergo lipid exchange (LX). Nanodiscs used to study lipid exchange are assembled with lipids, membrane scaffold protein (MSP), membrane proteins, and detergent. MSP can have a histidine (His) residue that interacts with the nickel on an immobilized metal affinity chromatography column, which allows the separation of different nanodisc populations pre-LX and post-LX. Typically, empty nanodiscs that do not contain a membrane protein are used as a control experiment because lipids should exchange to reach a 50:50 equilibrium between nanodiscs. When an exchange is performed with a membrane protein nanodisc, this equilibrium shifts, indicating a binding affinity for certain lipids to that protein. LX is analyzed using liquid chromatography coupled with mass spectrometry (LC-MS, on Waters Synapt XS). Here, we are specifically interested in how cholesterol impacts the structure and function of serotonin receptors. Future directions include using natural brain polar lipid extract within this process, and inserting the M2 influenza membrane protein, which has known interactions with cholesterol, into a nanodisc to observe its exchange behavior.

Gwendolyn McKay

Chemistry at University of Arizona

Mentored by Catharine Smith, PhD and Michael Arowosegbe (Pharmacology & Toxicology)



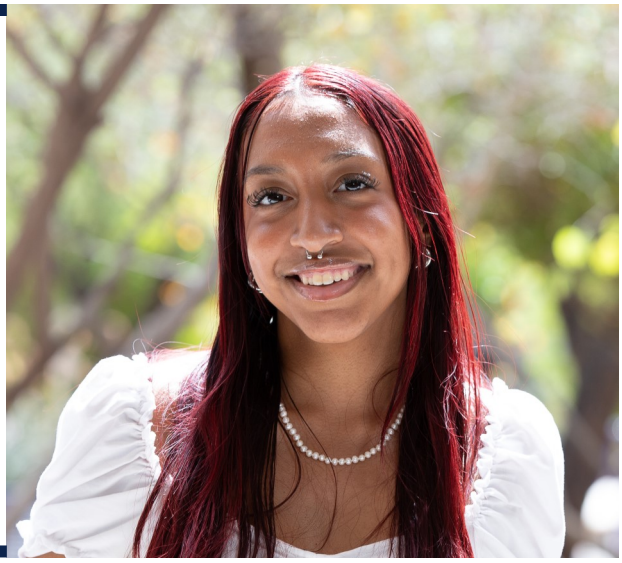
Lysine Deacetylase-Containing Complexes Aid in Facilitating Transcription of Glucocorticoid Receptor-Targeted Genes

It has been widely accepted that lysine deacetylases (KDACs) facilitate the repression of gene transcription through their post-translational modification of histone proteins. However, recent research has revealed that KDAC1, a Class I lysine deacetylase, has the ability to activate glucocorticoid receptor (GR) target gene transcription. Many factors are unknown about the function of KDAC1 as an activator of GR transcription, therefore we are currently focusing on determining how the KDAC1-containing protein complexes are important for transcription, and how they can be located within the genome. There are various kinds of protein complexes which contain KDAC1, but the Corepressor of Repressor Element-1 Silencing Transcription factor (RCOR/CoREST) complex has been shown to be the most significant promoter for transcription of GR-regulated genes. In the RCOR/CoREST complex, there exists a scaffold protein of which one variation–RCOR3 –has been observed to play a crucial role in KDAC1 function. Through a process of depleting RCOR3 protein, we have observed impairments in basal and induced transcription of four GR targeted genes, indicating the scaffold's necessity to KDAC1 function. Moving forward with the knowledge of RCOR3's importance, we are developing a biotin-ligase plasmid in order to observe–through proximity profiling–other proteins that may interact with the complex. By identifying which transcription-necessary proteins are biotinylated and acetylated, we can then examine their function as possible substrates for KDACs. Researching Class I KDACs and their substrates can provide a deeper understanding of their inhibitors, which can aid in our understanding of how these drugs affect endocrine pathways.

Avril Perez

Microbiology at University of Arizona

Mentored by Samuel K. Campos, PhD, Zachary Williamson, and Ashlin Schaefbauer (Immunobiology)



Uncovering HPV Helpers: Using a Split TurboID System for Proximity Biotinylation of PMLNBs during L2 HPV Infection

Human papillomavirus (HPV) is an oncogenic dsDNA virus that typically infects the anogenital region, causing STIs. HPV is made up of two capsid proteins, L1 and L2, which interact with host cell proteins during host entry. L2, the minor capsid protein, aids in entering host keratinocytes and reverse trafficking into the nucleus, where the virus is then dependent on mitosis to replicate its viral genome. Recent studies show that the virus interacts with proteins in promyelocytic leukemia nuclear bodies (PMLNBs) in the nucleus to facilitate replication and transcription of the viral genome. To find how the minor capsid protein L2 interacts with proteins at multiple stages of infection, we use the engineered enzyme TurboID, which converts biotin into biotin-AMP, a highly reactive intermediate that tags nearby proteins through biotinylation. While this was previously attempted with a non-split model of UltraID, it failed due to excess self-biotinylation that deactivated the system. The split model (two fragments, N and C) is therefore a more controlled model that we will use to determine which proteins are in proximity with L2 with more regulated self-biotinylation. With this model and the findings it produces, we hope to get a better understanding of the mechanisms and interactions of L2 during early stages of infection.

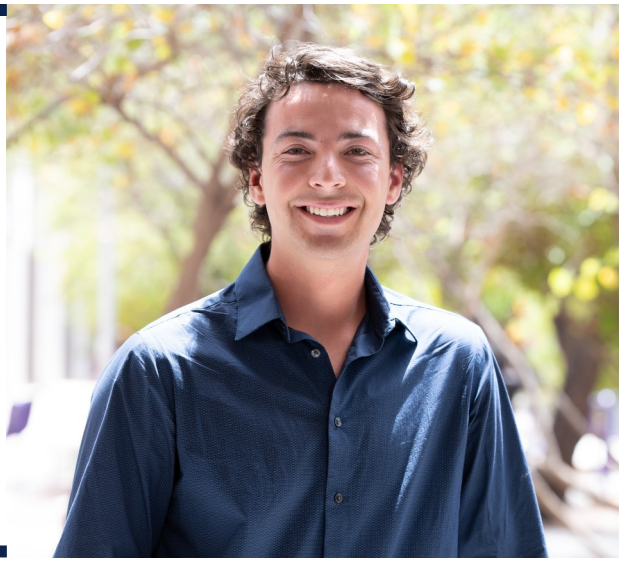
Ronald E. McNair Postbaccalaureate Achievement Program (McNair)

PI/Program Director: Caitlin Rosario Kelly, ABD
Administrative Assistant: Victoria Juvera
Graduate Teaching Assistant: Astrid Liu
Sponsors: U.S. Department of Education, Federal TRIO Program, Ronald E. McNair Postbaccalaureate Achievement Program (Award: #P217A220105), Western Alliance to Expand Student Opportunities (WAESO), University of Arizona Graduate College

John Casey

Biochemistry at University of Arizona

Mentored by Thomas Tomasiak, PhD (Chemistry & Biochemistry)



Identification of Novel Inhibitors Targeting the Valley Fever Protein Cps1 Using Molecular Modeling Techniques

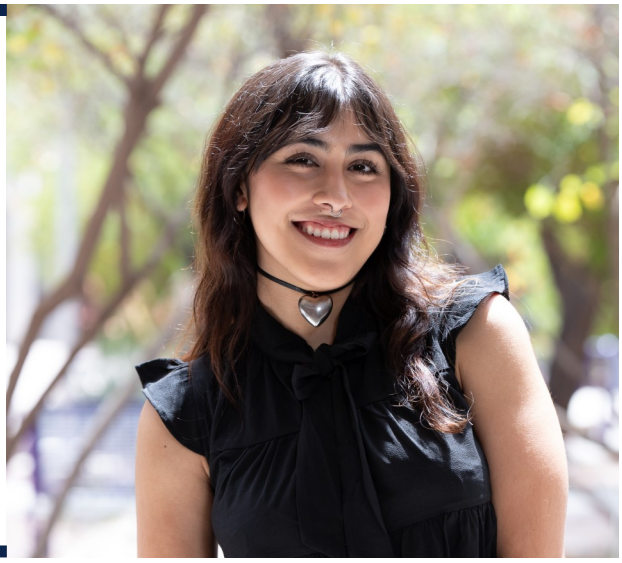
Coccidioides species (*C. immitis* and *C. posadasii*) are responsible for causing coccidioidomycosis or Valley fever, a fungal infection that spreads through inhalation of fungal spores. Valley fever currently affects 12 states on the West Coast of the United States and by 2095 the shifting climate will make much of the West Coast considered endemic. While the majority of infections resolve spontaneously with minor respiratory illnesses, occasionally the infection can spread through the bloodstream from the lungs, leading to progressive, prolonged, and potentially life-threatening complications. This calls for an urgent need for the identification and characterization of novel inhibitors that can target key proteins that are essential for virulence and cellular function in *C. posadasii*. Interestingly, mutagenesis studies in fungal maize pathogen *C.* heterostrophus led to the identification of Cps1. This Cps1 protein was then identified as a transmembrane protein having putative roles in key cellular mechanisms such as cell wall production, which is essential to the stability of the cells. Importantly, Cps1 mutant *C. posadasii* strain failed to cause the disease in healthy and immunocompromised mouse models further indicating the crucial role of Cps1 in disease progression.

The present study aims at the identification and in-silico, or computer-based, characterization of novel inhibitors that could target and inhibit the functions of Cps1 using a combination of molecular modeling, ligand database screening, computational docking, and molecular dynamics simulations. The best hits, or candidates most likely to show strong binding affinity, coming out of the computational analysis will hold tremendous potential in inhibiting the functions of Cps1 in vitro and can be further tested in vivo on mouse models for further validation. By finding these molecular compounds, known as ligands, that bind to the Cps1 protein and ensuring they exhibit inhibitory effects, the Cps1 protein can effectively be suppressed and the virulence of Valley fever eliminated. This would result in a novel treatment of the disease and progress our understanding of specific protein-ligand binding interactions in the field of biochemistry.

Leelu Cervantes

Psychology at University of Arizona

Mentored by Jessica Andrews-Hanna, PhD and Vannia Puig Rivera, MA (Psychology)



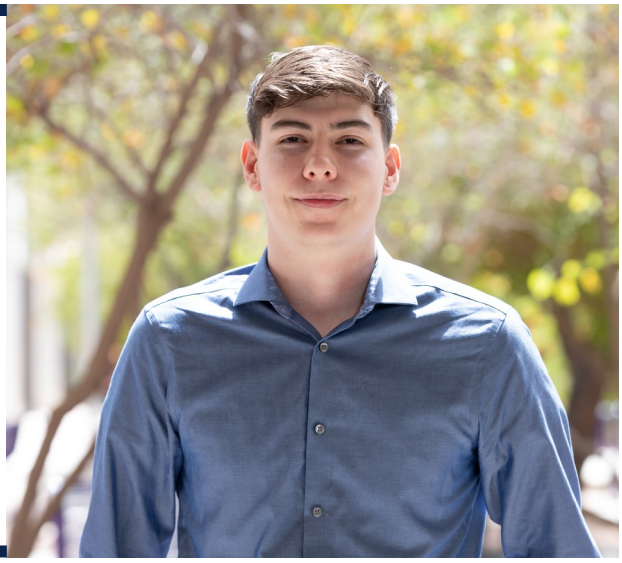
Investigating Age Differences In Autobiographical Thought Using An Experience Sampling and Text Analysis Approach

Autobiographical thinking pertains to thoughts related to the self. This field highlights autobiographical memories (AM), which are essential to supporting and developing personal identity throughout one's lifetime. Previous research on AM has yielded mixed results, particularly regarding the effects of age on the contextual quality of older adults' autobiographical recollections. This prompts the question of whether there may still be misunderstandings about age-related shifts in cognition. This study examines phenomenological characteristics (e.g., valence, episodic specificity, focus on self or others, arousal) of autobiographical thoughts and memories using an experience-sampling app called MindWindow. Across two weeks, approximately 3,000 participants (ages 18-89) received daily MindWindow notifications prompting them to complete a questionnaire on several thought characteristics and provide text descriptions of their ongoing thoughts. Repeated measures of thought characteristics were averaged and compared between age groups. Text descriptions were then analyzed using the computerized text analysis program LIWC to address the validity of the self-reported data. Initial analyses revealed an expected age effect on valence (e.g., positivity bias) as well as findings that diverge from typical patterns, particularly concerning episodic specificity. Interpretations and future possibilities of these outcomes are discussed.

Cipriano Childers

Physiology and Medical Sciences at
University of Arizona

Mentored by Shanna Hamilton, PhD (Cellular & Molecular Medicine)



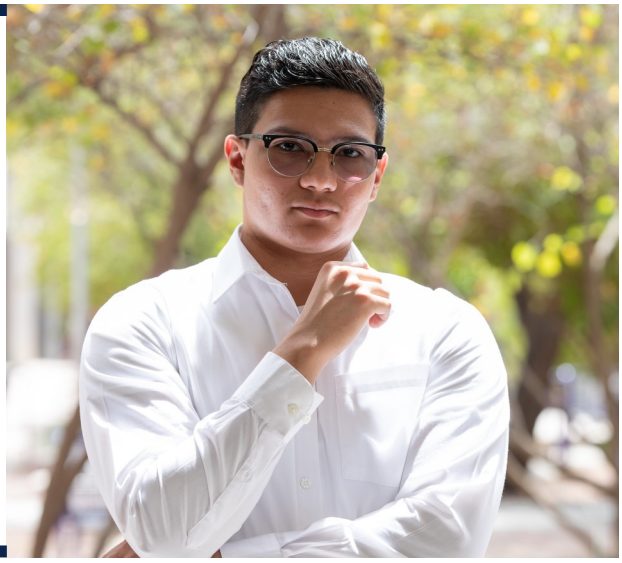
Coronary Heart Disease: Unraveling UPR Pathways and Contributing Factors

X-box binding protein 1 (XBP1) is a transcription factor located primarily in the nucleus of the cell. The role of XBP1 in the pathophysiology of Coronary Heart Disease (CHD) is due to its interaction in the unfolded protein response (UPR) pathway and interaction with oxidative stress. XBP1 is activated from splicing of the mRNA by a ER stresser sensor IRE1-alpha and then expressing genes involved in cell protein folding and ER-associated degradation. The Hamilton lab studies cardiovascular diseases and uses molecular mechanisms to discover new therapeutic approaches to prevent and treat arrhythmias in the heart. In this study, we investigated that increased reactive oxygen species (ROS) lead to elevated XBP1 levels in coronary heart disease. This would indicate that XBP1 is an adaptive response to oxidative stress in cardiovascular tissues. XBP1 splicing and Polymerase Chain Reaction (PCR) was used on ventricular myocytes from rats and catecholaminergic polymorphic ventricular tachycardia (CPVT) from mice which detects the correct spliced forms of XBP1 mRNA, indicating activation of UPR pathways in cells under stress conditions and the extent of ER stress and cellular response by XBP1. Our findings of the role of XBP1 in cardiovascular tissues provides evidence of its involvement with the UPR pathways and ER stress. Using PCR shows a positive correlation between increased ROS and XBP1 expression.

Julio Corona

1) Physics 2) Astronomy at University of Arizona

Mentored by Eduardo Rozo, PhD (Physics)



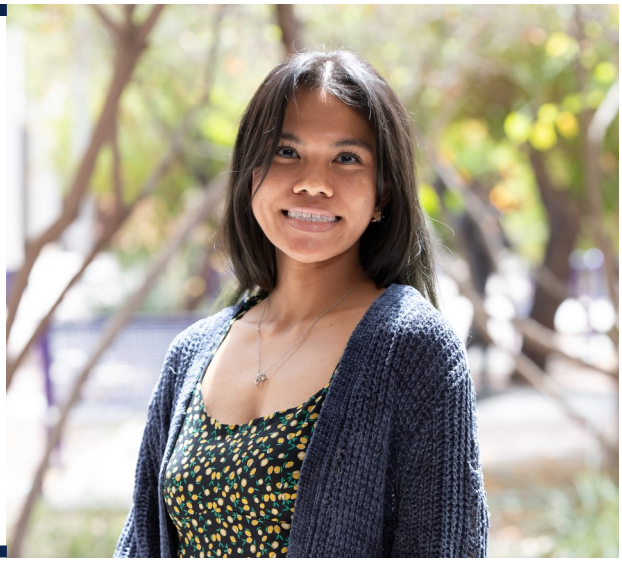
Log-normal Calibration for Weak Lensing Studies

Understanding large-scale structures is crucial to cosmology, providing insights into structure formation and composition. Comprehending how galaxies clump together and spread out overall will give insight into the universe's history (cosmology). Weak lensing, a phenomenon where gravity bends light around an object, causes the projected matter density of the Universe, denoted as κ, to function as a lens that distorts the images of background galaxies (Bartelmann & Maturi, 2016). Because more mass and denser distributions lead to more distortions, this effect can be used to map out the universe's matter density. These maps reveal details of large-scale structure such as its general shape and distribution. In making these maps astronomers can also graph the density observed versus frequency of observation in a histogram. This allows our study to employ the use of a statistical description of the matter distribution. In this work, we characterize the cosmological dependence of the shift parameter in a statistical description called the log-normal approximation, using numerical simulations. We then build an emulator to predict the shift parameter of the log-normal distribution at different distances as a function of cosmology. This emulator provides simulation tools for future weak lensing studies and insight into large-scale structures. This in turn means that we build better maps of large-scale structures from weak lensing effects and gain insight into how our universe evolved from the beginning to modern day.

Jenna Jealene Dacayanan

Psychological Science at University of Arizona

Mentored by Mary-Frances O'Connor, PhD, Sydney Friedman, MA, Yvette Pino, and Dominique Simms, MSW (Psychology)



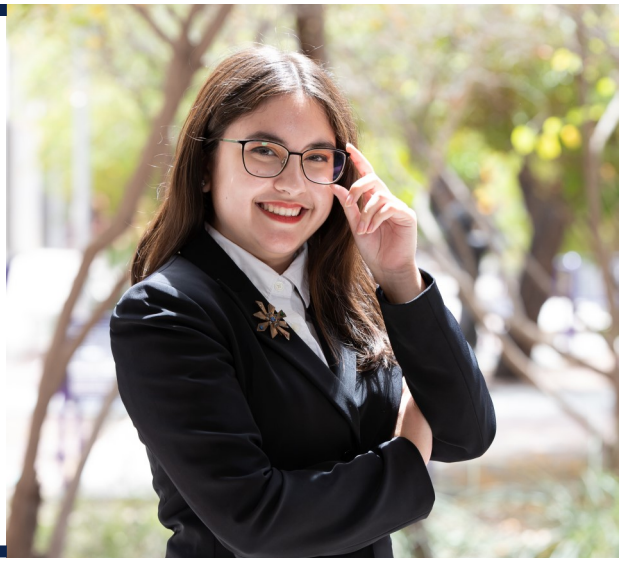
Grief Is a Form of Love: A Scoping Review on Bereavement and Loneliness in Older Adulthood

By age 75, nearly 58% of women and 28% of men in America have been widowed, making bereavement a significant event in older adulthood (U.S. Census Bureau, 2021). Recently, severe grief symptoms have been recognized with the inclusion of prolonged grief disorder (PGD) to the DSM-5-TR. Additionally, bereaved older adults are at risk for loneliness and depression. This scoping review points out gaps in the literature about bereavement in older adulthood and the relationship between loneliness, grief, and depression. For this review, articles were sourced from Pubmed, PsycInfo, and EbscoHost using the following search terms: older adult, grief, bereavement, loneliness, isolation, depression, and late-life depression. Specifically, searches were limited to those published since 2020, to understand the experiences of older adults during the COVID pandemic. After excluding articles not meeting criteria, we reviewed the relevant findings from n=21 articles. The emerging findings revealed that the severity of the feelings of loneliness post-loss strongly associated with the level of depressive symptoms experienced; when both were severe, a bereaved older adult showed a higher risk of developing maladaptive grief reactions, most notably PGD, but also commonly seen among the 21 included studies was major depressive disorder (MDD), post-traumatic stress disorder (PTSD), and anxiety. While loneliness is common in both PGD and depression, it was found to be more prominent in PGD and may prompt the onset of depressive symptoms in bereaved individuals. Studies suggest feeling lonely after bereavement may be a path to increasing both PGD or depression, or their overlap. This highlights PGD as a complex mental disorder separate from MDD. The identification of this relationship paves the direction for future research on grief and for the development of interventions that protect older adults against loneliness.

Vivianna Pederson

Neuroscience and Cognitive Science at
University of Arizona

Mentored by Haijiang Cai, PhD (Neuroscience)



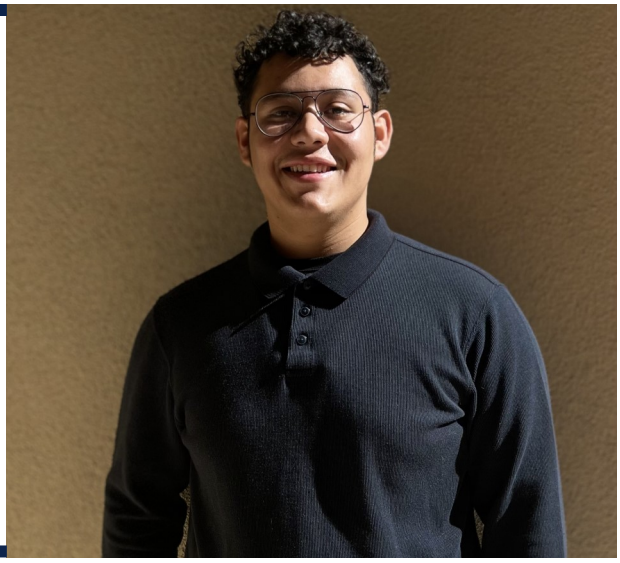
The Effect of Central Extended Amygdala Neurons on Mouse Estrous Cycle

The current literature using the Activity Based Anorexia (ABA) animal model as a method of studying human Anorexia Nervosa (AN) has produced inconsistent results when used to explain the differences in developing this disorder based on biological sex. As a result, these studies have not determined the underlying neural mechanisms of these inconsistencies. Past research shows that a subpopulation of neurons within two subregions of the central extended amygdala (EAc) exhibit traits of sexual dimorphism and are necessary for the development of ABA. Using Designer Receptors Exclusively Activated by Designer Drugs (DREADD) technology, we were able to add and individually target the hM3Dq receptor within these two subregions necessary for ABA development. The activation of these regions is expected to disrupt the levels of sex hormones causing changes in the estrous cycle, thus identifying the central extended amygdala as a potential region of interest for sex differences in ABA. This study tests this concept by measuring the effect of activating these neurons on sex hormones in 13 mice through estrous cycle testing. This study resulted in no discernible connection between the activation of the neurons within the two subregions in the EAc individually and estrous cycle changes. Based on these results and research by Scnapp et al. (2024), a future study focusing on simultaneous activation of the two subregions in the EAc may provide insight into the sex differences in ABA development. Understanding how these neural mechanisms are affected by sex is essential for improving treatments for AN.

Patrick T. Quintero

Psychology at University of Arizona

Mentored by Melissa Y. Delgado, PhD and Rajni Nair, PhD (Human Development and Family Science)



Without Significant Relationships, You Don't Have Significant Learning: A Thematic Analysis

Teacher-student relationships are key to youths' educational environments (Cornelius-White 2007). Previous research shows supportive teacher-student relationships are associated with positive youth outcomes such as achievement and school belonging (e.g., Allen et al. 2018, Cornelius-White 2007; Roorda et al. 2011). Much of the research indicates that social support is associated with positive student-teacher relationships, so understanding how teachers interact and experience Latinx students through sub-categories of social support is important. Therefore, this study investigated how middle school teachers describe their social support efforts with Latinx middle school students. Data for this study come from a larger mixed methods study of school climate among Latinx families and teachers in the Southwest. This study utilized focus group data from middle school teachers (N=18) about their experiences with Latinx students. Data was analyzed using inductive and consensus coding (Hill et al., 1997; Thomas, 2006). Preliminary findings revealed themes such as positive cultural engagement. Teachers reported that they perceived students valued teachers' efforts to honor students' language through the proper pronunciation. For example, a teacher noted, "I was doing attendance, and a kid said, 'Oh, you said my name right! They remember that and get super excited". However, teachers also reported themes related to language barriers, stereotyping, and cultural disconnect. Such findings indicate that teachers identify both areas of connection and support alongside challenges in their relationships with Latinx students.

Melissa Romero

1) Linguistics 2) Neuroscience and Cognitive Science at University of Arizona

Mentored by Genesis D. Arizmendi, PhD and Camila Itzel Castillo (1) Cognitive Science 2) Speech, Language, and Hearing Sciences)

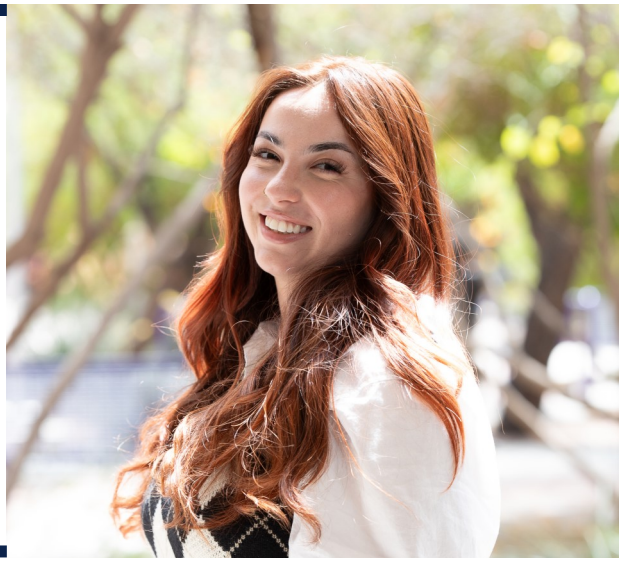
Development and Refinement of Semantic Networks in Spanish-English Bilingual Children

This study investigates the development of semantic networks in typically developing Spanish-English bilingual children from 1st to 3rd grade, utilizing narrative language sample analysis. The research aims to understand how these samples reflect developmental trajectories in English and Spanish semantic networks and the subsequent implications for language dominance in English-only, subtractive educational settings. The study sample comprises 60 bilingual children (N=60) from Southern Arizona, divided into two groups: 30 first graders and 30 third graders. Narrative samples were elicited in both languages using the wordless picture book “Frog, Where Are You?” by Mercer Mayer. These narratives were transcribed and analyzed using the Systematic Analysis of Language Transcripts (SALT) to evaluate phonological, morphological, syntactic, and semantic errors. Error analyses of English narratives reveal a decline in phonological errors and improved semantic categories by 3rd grade, while Spanish narratives exhibit varied development. Preliminary results demonstrate more advanced morphological and semantic structures in English compared to Spanish, likely due to extensive English exposure in their school environment. This environment appears to promote greater familiarity with English phonology, as phonological errors were exclusively found in Spanish narratives. This study provides crucial insights into bilingual language development for clinicians and educators and challenges monolingual biases. Understanding typical bilingual patterns is vital for fair educational decisions, especially in minimizing the historic over- and under-identification of students for special education services. This research underscores the importance of an informed, asset-based approach to bilingual research, especially in contexts with prevalent English-only policies.

Victoria Rueda

Human Development and Family Sciences at University of Arizona

Mentored by Melissa Flores, PhD (Psychology)



Examining the Relationship Between Familial Support and Blood Pressure: The Mediating Role of Perceived Stress Among Historically Excluded Older Adults

Introduction. Research indicates that among historically excluded older adults, familial relationship quality and support can influence perceived stress and health. What is less clear is whether perceived stress mediates the relationship between familial support and blood pressure. In this study, we aimed to assess whether the frequency of reliance on family support or the number of close relatives were associated with blood pressure five years after baseline, mediated by perceived stress.

Methods. Longitudinal, observational survey data was previously collected by the National Social Life Health and Aging Project (NSHAP). Specifically, we used a subset of participants from historically excluded groups who did not take antihypertensive medications, with complete data at Wave 1 and Wave 2 (N = 783). Analyses included regression and mediation models.

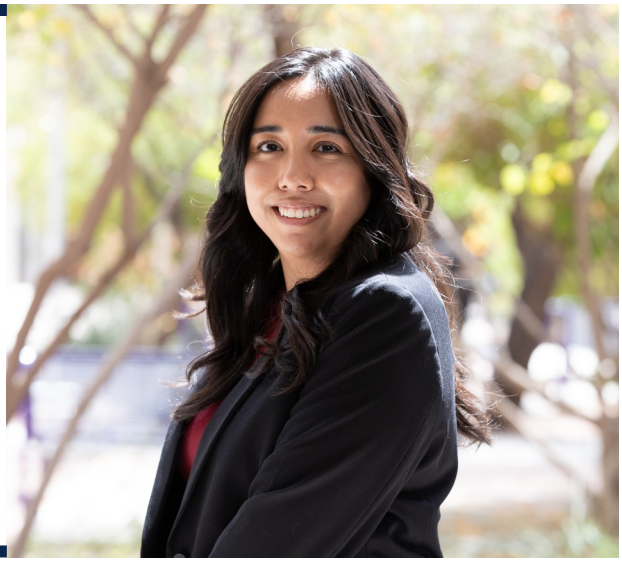
Results. Although neither reliance on family nor the number of close relatives was associated with diastolic or systolic blood pressure five years later, and perceived stress did not mediate these associations, the number of close relatives was associated with perceived stress five years later. This was observed after controlling for perceived stress and other demographic and health-related factors at baseline, $F(4, 369) = 2.27$ $p = 0.047$. We found that compared with respondents who reported zero close relatives, those with 10-20 (b=-0.56, 95% CI(-1.07, -0.04), p=0.03) or 20 or more (b=-0.58, 95% CI(-1.09, -0.07), p=0.03) reported significantly less perceived stress 5 years later.

Conclusion. The number of close relatives may mitigate long-term stress among historically excluded older adults.

Jessey Singh

Creative Writing at University of Arizona

Mentored by Stacey Cochran, PhD (English)



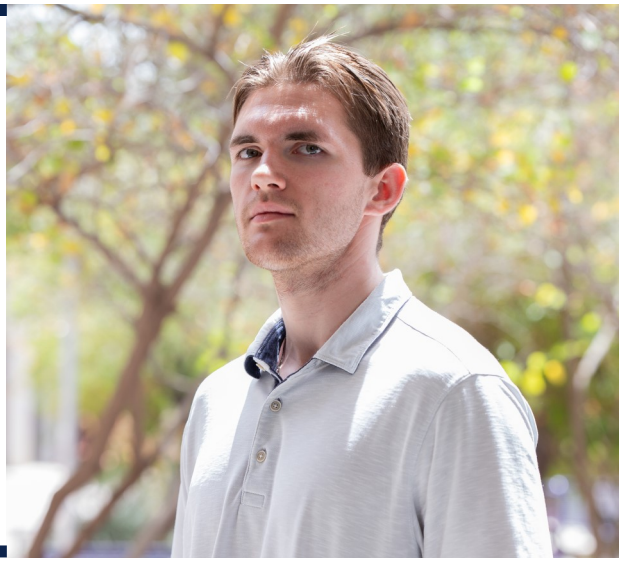
Censored Stories, Silenced Identities:
The Intersection of Book Bans, Education, and Ethnic Identity in America

In the United States, targeted book bans undermine students' access to racially and culturally diverse literature, promoting the oppression of marginalized students' identities. Although educators are often aware of the ramifications of such censorship, government officials and parents advocating for the removal of books due to disapproval of certain themes rarely comprehend the adverse impact of their actions. My research utilizes James Marcia's Identity Status Theory to frame a comprehensive literature review and analysis, demonstrating that removing diverse stories and literature actively limits students' potential to form well-rounded and constructed identities. The book ban movement is systematically infiltrating educational policies and fuels ethnic oppression, as exemplified by Tucson's ban on Mexican American Studies, which emphasizes the restrictions on identity formation among high school students. These conclusions underscore the critical importance of preserving diverse literature in schools, as book censorship not only diminishes educational experiences but also erodes the identities and well-being of students. Ensuring access to a wide range of stories is essential for fostering an inclusive educational environment and providing the necessary tools for well-rounded identity formation.

Anthony Somohano

1) Economics 2) Management Information Systems at University of Arizona

Mentored by Christian Cox, PhD (Economics)



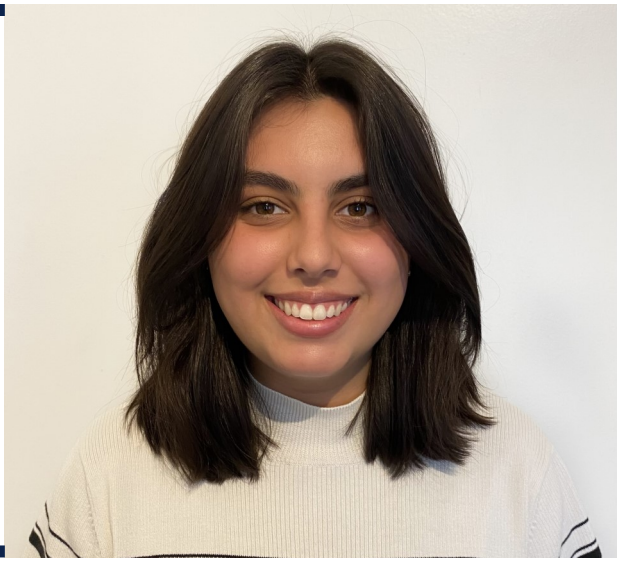
Binary Forecasting of Stock Movement Using Machine Learning

Predicting the direction that a stock will move is of paramount importance to investors. This is especially true when it comes to short-term stock trading, which is generally considered to be riskier due to the high volatility in the stock market. The purpose of this project is to compare the short-term forecasting abilities of four models: Linear Regression, Logistic Regression, Artificial Neural Network (ANN), and Support Vector Machine (SVM). I tested the four models on a dataset containing the daily price variables, and volume of every stock on the NYSE and NASDAQ from 1/1/1962, to 11/10/2017. I then compared their ability to make accurate predictions on the closing prices movements over 1, 3, and 5 business days. My findings show that the machine learning models performed substantially better when it comes to making short term predictions with a 1-day prediction accuracy of 52.3% from both SVM and the ANN when compared to 51.4% from both the regressions. However, the Regression models are more accurate in predicting price movement over 3 and 5 days, achieving 5-day accuracies of 51.7% and 3-day accuracies of 51.3%. In comparison, the ANN achieved accuracies of 50.6% and 51.5%, while the SVM had accuracies of 50.7% and 51.3% percent over the 3-day and 5-day periods. I also found that all the models had a drop in accuracy when making predictions 3 days ahead.

Maya Steinberg

1) Mexican American Studies 2) Gender and Women's Studies at University of Arizona

Mentored by Maurice Magaña, PhD (Mexican American Studies)



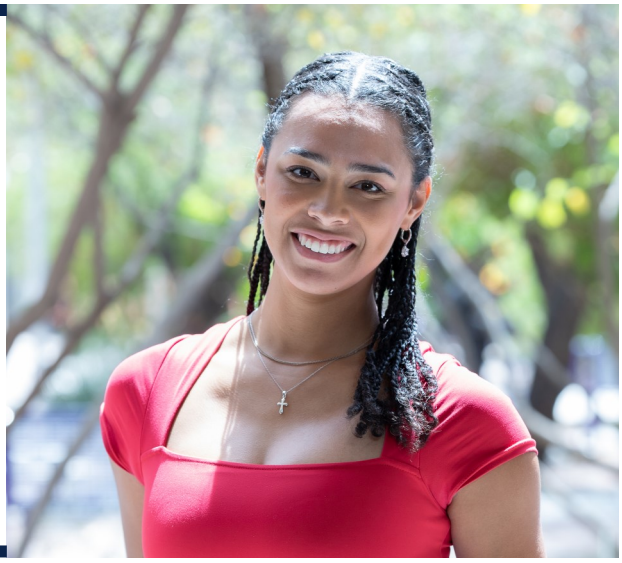
A New Origin Story: Beyond Mestizaje and Toward a Poetics of Relation

Mestizaje is a concept with a five-hundred-year history in the Americas and an origin story that is overrepresented as the only viable model of conceptualizing our sense of who 'we' are. Alongside scholars working at the transdisciplinary intersections of Ethnic Studies, American Indian Studies, and Black and Indigenous Feminisms, I argue that the dominant story of Mestizaje operates through a logic of differentiality (Azoulay, 2019), that yields a confidence and desire to state, without challenge or equivocation, that there are Indians, non-Indians, and in vast contrast, mestizos (Saldaña Portillo, 2001). My work troubles this logic and offers the possibility of a different origin story, one that, following Reid Gómez, enacts multiplicity and nonlinearity as a decolonial method of story to move away from oppositional frameworks and toward a more fluid poetics of relation. While a dominant story of Mestizaje addresses a hi (story) of racial formation through the singular miscegenated body, my work attends to the bodies that are not only mine, an analytic that centers the elaborate connections that exist between racialized bodies of people, land, water, and literature. To do so, I ask: How might storytelling, with the ability to drift across multiple hi(stories), languages, biases, and allegiances, restore relationality? The contributions of this study aim at the horizon of an elaborate story structure – one that might interrupt the still-unfolding hi(stories) of violence that reinscribe Mestizaje, and instead, challenge us, as storytellers, to realize relations and capacities that have been here all along.

Aaliyah Thompson-Mazzeo

1) Biomedical Engineering and 2) Mechanical Engineering at University of Arizona

Mentored by Andrew J. Fuglevand, PhD (Physiology)



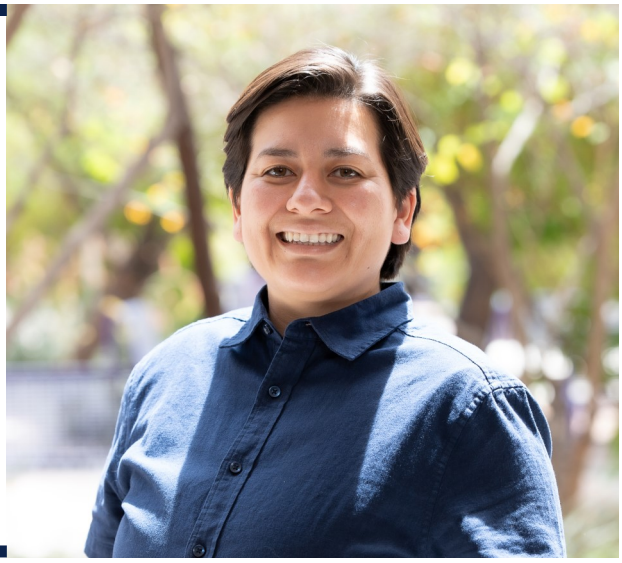
Non-Invasive Methods to Control a Robotic Arm:
A Review of Current Methods and Research to Enhance Autonomy in High-Level Tetraplegics

Paralysis affects nearly 5.5 million people in the United States. One major cause of paralysis is spinal cord injury (SCI) and ~ 50% of SCIs result in tetraplegia, 34% of whom have high-level lesions that leave individuals unable to use the entire upper limb, including the hand. While multiple studies have focused on restoration of movement in tetraplegics using Brain Machine Interfaces (BMIs) and Functional Electrical Stimulation (FES), these methods are expensive, invasive, relatively short-lived, and involve substantial risk for patients. This study sought to determine the most optimal, non-invasive method for people with high-level tetraplegia or amputation to control a robotic arm as a movement aid. There were 10 subjects tested using several different control modalities for moving a robotic arm: head movements, facial muscle electromyography (EMG), intra-oral tongue sensors, and voice. For the first session, hand movements using a joystick are used to control the robot arm to provide a benchmark comparison. For each control modality, the subject made 72 reaches with the robotic arm to 12 different targets repeated 6 times each. Movement time and normalized path length were measured for each trial. In testing with two subjects thus far, head position, tongue, and voice were equally effective in controlling the robot arm as hand movements. These results suggest that simple, affordable, and non-invasive methods could be readily used by high-level tetraplegics to control an assistive robotic arm and thereby enhance their autonomy and sense of well-being. Optimizing non-invasive control modalities will make healthcare for tetraplegics and amputees more accessible, improving overall quality of life.

Lyrissa Nicole

Studio Art: 3D and Extended Media emphasis at University of Arizona

Mentored by lydia see, MFA (School of Art)



From Museums to Studios: Empowering Artists with Accessibility Guidelines

Diversity, equity, inclusion, and accessibility are critical topics in contemporary art museum studies. Although some institutional guidelines have been issued to make artwork more accessible, they can be financially burdensome. The crucial task of making these spaces accessible is left to museum professionals only after the art has been created, which can sometimes fail to convey the artist's intent. Current research focuses on institutional guidelines, with little attention given to steps artists can take to make their art accessible to diverse audiences. Drawing inspiration from museum accessibility best practices, I developed a versatile set of guidelines for artists to consider and apply to new and existing artworks intended for exhibitions. These guidelines were then applied to my existing artwork to provide examples for artists on how to make their artwork accessible in accordance with institutional best practices. The practical application and assessment of these guidelines are beneficial for future collaborative efforts between artists and museum professionals. These guidelines not only give artists the fundamental tools to make their art more accessible, but they enhance the overall experience for those who interact with the artwork, fostering a more inclusive community.

Ava Ventimiglia

Psychological Science at University of Arizona

Mentored by Jessica Andrews-Hanna, PhD, Diego Guevara Beltran, PhD, and Kayleigh Cook (Psychology)

Relationship Satisfaction: The Effects of Depression and Rumination

Relationship satisfaction is important because relationships are a key aspect of human existence. Quality relationships have a positive impact on our overall health and longevity. Relationship satisfaction impacts the perceived quality of the relationship. Previous studies have found that depression and rumination (e.g., negative repetitive thinking) are negatively associated with relationship satisfaction because they increase the presence of negative information and can cause more negative interpretations of one's partner. This connection has implications for depression and rumination causing a decline in overall relationship quality which can further maintain distressing symptoms. Previous research has focused on the impact depression and rumination have at the individual level, but the field is lacking in data on the impact of these symptoms at the couple level. The current research seeks to address this gap by examining the relationship between one's own depression and rumination and the impacts it has on both them and their partner. We studied cohabiting couples, measuring depression, rumination, and relationship satisfaction in a week-long daily diary, and 1-3 days following the daily diary. Preliminary correlation analyses show a positive relationship between depression and rumination as well as a negative association between depression and rumination with relationship satisfaction. When looking at partner effects, we find that one partner's depression and rumination are not significant predictors of the other's relationship satisfaction. These analyses suggest that there is a possible mediating effect of rumination on relationship satisfaction. Further analyses using regression and the Actor-Partner Interdependence Model will examine bidirectional effects within couples. Examining depression and rumination dyadically will provide a deeper understanding of the negative interdependencies among partners that can hinder relationship satisfaction.

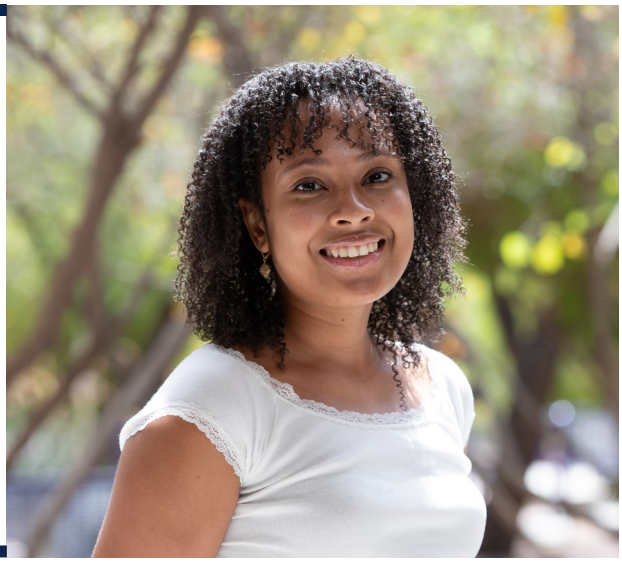
Minimizing Health Disparities (MHD)

Program Coordinator: Tianna Urrea MacMeans
Facilitators: Cindy Neal, MEd and Tianna Urrea MacMeans
Sponsors: Western Alliance to Expand Student Opportunities (WAESO), University of Arizona Graduate College

Saniya Barbour

Neuroscience at University of Arizona

Mentored by Paul Langlais, PhD, Emilie Lu, and Mac Mcgraw (Medicine)



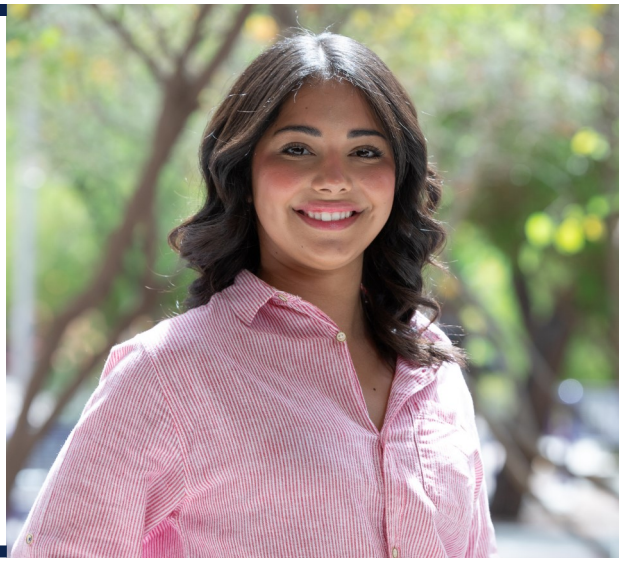
Understanding TAK1's Possible Role in Insulin-Stimulated Glucose Uptake

Diabetes is a chronic disease caused by insulin resistance (Type 2) or the body's inability to produce enough insulin (Type 1) to maintain a healthy glucose level, with about 1.2 million Americans diagnosed with the condition every year. The process of normal insulin-stimulated glucose uptake involves a series of proteins mediating the appearance of protein GLUT-4 at the cell membrane. However, despite a basis of understanding regarding how this process occurs, little is known about the specific proteins that facilitate the transport and stabilization of GLUT-4 at the cell membrane. Throughout this summer, I sought to not only understand how insulin-stimulated glucose uptake occurs experimentally, but also investigate the protein TAK1's possible role in this process.

Karelis Burgos Candelaria

Industrial Microbiology at
University of Puerto Rico, Mayaguez

Mentored by Klearchos Papas, PhD, Amy Kelly, PhD, Craig Weber, Carola Davila, and Ilga Rutins (Surgery)



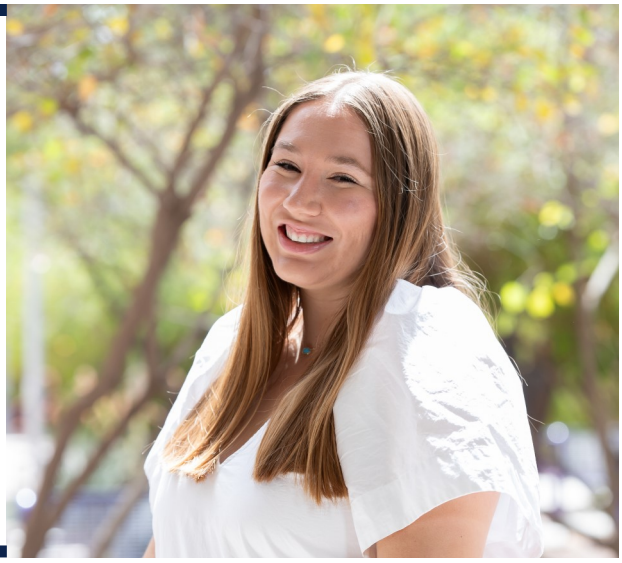
3D Culture of Insulinoma Spheroids for Diabetes Research

The pancreas contains Islets of Langerhans, which are responsible for controlling whole body glucose homeostasis. Isolating islets for research use is expensive and challenging; animals need to be euthanized and islet yield and size can be inconsistent. Previously, this laboratory developed a protocol to create pseudo-islets from the rat insulinoma cell line INS832/3. Using a spinner flask, spheroids are simple to generate and had similar characteristics to rat islets, including a large variation in spheroid size. However, having large spheroids that are highly variable in size are not ideal in a situation where oxygen and nutrients are limited, such as cell encapsulation therapy. The objective of this study was to determine whether INS832/3 spheroids could be created using a commercially available static 3D culture plate (Kugelmeier SPHERICALPLATE 5D), which is reported to grow small, uniformly sized spheroids. INS832/3 cells were cultured in T75 flasks, trypsinized, counted, and plated into either a spinner flask or 3D culture plate in triplicate (three unique passages). After three days of culture, spheroid size distribution, viability, and oxygen demand were determined. Spheroids from the 3D culture plate were smaller and more uniform in size; 76.84 percent of spheroids from the 3D culture plate were between 100 to 200 microns in diameter compared to 5.41 percent from the spinner flask. These spheroids also had a comparable viability and oxygen demand to the spheroids grown in spinner flasks. Using these 3D culture plates could be advantageous to grow uniformly sized cell aggregates for cell encapsulation therapies.

Isabella Ducey

1) Creative Intelligence and Innovation 2) Nutritional Sciences: Nutrition emphasis at University of Arizona

Mentored by Floyd "Ski" H. Chilton, PhD and Faith Curran (Nutritional Sciences and Wellness)



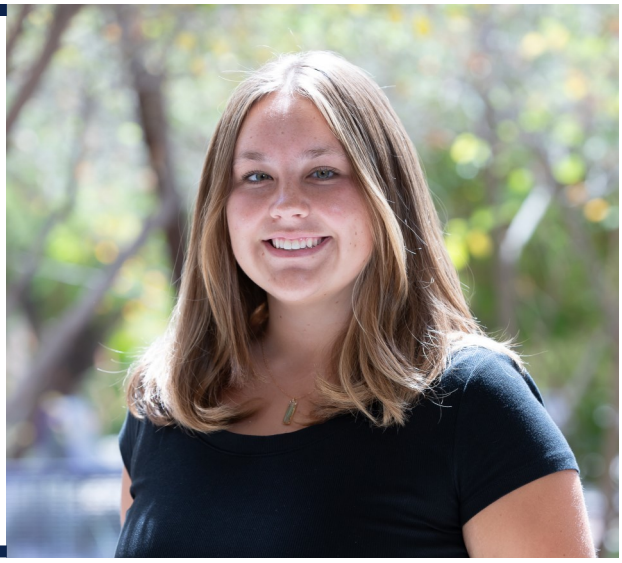
Potential Role of PLA2-G10 in Aggressive Forms of Non-Small Cell Lung Cancer (NSCLC)

Lung cancer is one of the leading causes of global cancer deaths, with ~85% of cases being Non-Small Cell Lung Cancer (NSCLC). Recent studies show that a member of the secreted PLA2 enzyme family may be playing a critical role in the aggressiveness of NSCLC [1, PMID:38669316]. Specifically, certain types of NSCLC express very high levels of PLA2-G10, which is thought to inhibit the chemotaxis of CD4+ and CD8+ T cells to tumor cells1. This in turn prevents T-cells from approaching and killing tumor cells. Our overall hypothesis is that the production of PLA2-G10 represents a novel mechanism by which aggressive NSCLC evades the immune response. Our work examined several cell lines, including Epidermal Growth Factor Receptor (EGFR) mutated and EGFR wild-type NSCLC cell lines. EGFR regulates cell proliferation, differentiation, migration, and survival; EGFR mutants are more oncogenic and resistant to immunotherapy [2, PMID:34206026]. We show that EGFR-mutated NSCLC have high levels of PLA2-G10 mRNA (400-fold) when compared to EGFR wild -type NSCLC. This data raises questions as to whether PLA2-G10 is a critical mechanism that facilitates tumor aggressiveness and immunotherapy resistance.

Shea Hollis

Molecular & Cellular Biology at University of Arizona

Mentored by Lisa Nagy, PhD and Maryalee Roazen (Molecular & Cellular Biology)



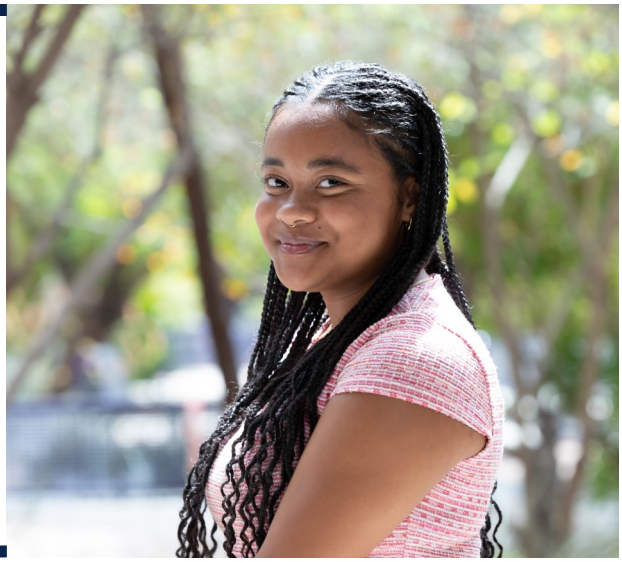
Even even-skipped evolved! The Evolution of Segmentation.

The evolution of segmentation remains a mystery. Segmentation is the process of dividing up an organism's body into repetitive units. Arthropods, annelids, and chordates are all segmented, however, their closest sister groups are not. Did they have a common ancestor, or did segmentation evolve three separate times? Segmentation differs between organisms even within the same group. Two arthropods *Drosophila melanogaster* (the fruit fly) and *Tribolium castaneum* (the red flour beetle) differ in their mechanisms of segmentation. *Drosophila* makes its segments simultaneously, and *Tribolium* makes its segments sequentially. Although they have these differences, the first gene expressed in segments in both species is *even-skipped (eve).* The *eve* enhancers in *Drosophila* have been heavily studied and mapped, however, nothing is known about *Tribolium's eve* enhancers. Through preliminary exploration of the 3.6 region, predicted to be a *Tribolium eve* enhancer, we have found that this region drives expression in early stripes that follow endogenous *eve* expression. As the embryo adds more segments, mCherry expression is limited to a posterior gradient in the area where the most recent stripe is developing. The last *eve* stripe, stripe 8, forms without mCherry expression. Eventually, mCherry is expressed again, transiently, in the anal plate and hindgut. Overall, the 3.6 region may have multiple, separable enhancers. Future experiments can subdivide the fragment to discover where the specific enhancers are and what expression pattern each one controls. Understanding how transcription of the *Tribolium eve* gene is controlled will give us insight into how arthropod segmentation has evolved.

Kayla Jones

1) Molecular & Cellular Biology 2) Psychological Sciences at University of Arizona

Mentored by Sima Ehsani Chimeh, MD and Lauren Maynard, MS, CGC (Medicine)



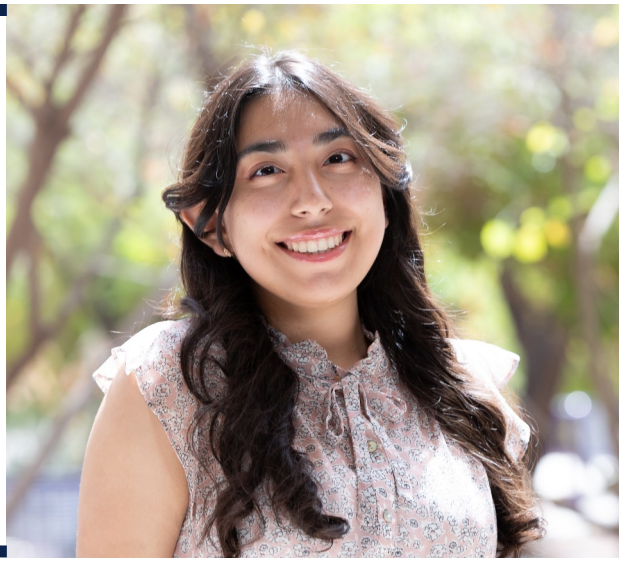
Germline Mutation Spectrum, Demographics, and Outcomes in Patients at the University of Arizona Cancer Center: A Retrospective Analysis

Cancers have been demarcated into the following categories: 'hereditary', caused by inherited genetic mutations, and 'sporadic', caused by spontaneous mutations accumulated over a person's life due to various risk factors. Most cancers are sporadic, while 5-10% are hereditary due to germline mutations. Genetic counseling and testing provide insights into germline mutations and its correlation with cancer risks. The purpose of this study was to characterize a cohort of patients who have undergone genetic counseling and testing at the University of Arizona Cancer Center (UACC) and tested positive for pathogenic mutations related to cancer risks. This retrospective analysis utilized the UACC's clinical genetic counseling patient database, Progeny, to evaluate potential health disparities by analyzing cancer diagnoses, germline mutations, race/ethnicity, risk factors, age, and zip code. Medical and ancestry information from Progeny for 904 patients was run through statistical tests using Microsoft Excel and RStudio. Patients with cancer (N=472, 52.21%) ranged 70+ years, with the highest rate of cancer occurring between ages 65 and 74. The most common mutations in the database were *BRCA2* (N=211, 23.34%) and *BRCA1* (N=121, 13.38%). Patients from 2 countries and 14 states received care at UACC, 54.42% having Pima County zip codes. Of the 904 patients (F=704, M=199), 66% identified as White/Caucasian and 24% identified as Hispanic/Latino, the largest populations to be treated at UACC. Genetic counseling and testing should expand scope and accessibility to help individuals understand cancer susceptibility and make informed decisions.

Yeira Lopez

Neuroscience at University of Texas, El Paso

Mentored by Nicole Marrone, PhD, CCC-A (Speech, Language & Hearing Sciences)



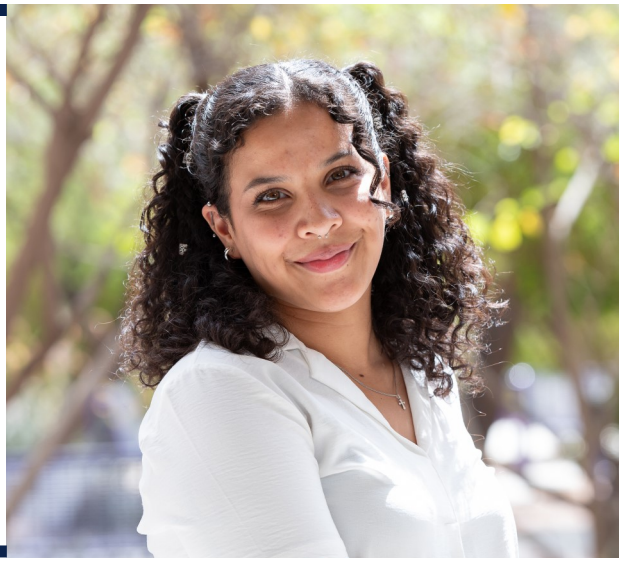
U.S. Geographical Variation of Deafness or Serious Hearing Difficulty

Hearing loss is a prevalent health issue affecting people worldwide. According to the Behavioral Risk Factor Surveillance System (BRFSS), the prevalence of deafness or serious difficulty hearing in the United States was 5.8% in 2016 (Li et al, 2018). Interventions like hearing aids and cochlear implants help amplify sounds and can improve a person's ability to listen and participate in daily life activities. However, the average cost of hearing aids is approximately $5,000 per pair (Jilla et al, 2020). Due to this substantial out-of-pocket expense, many American adults have been unable to afford them. Some federal health insurance programs, such as Medicaid, offer limited assistance with the costs of hearing aids and their maintenance. We first reviewed 2024 policy data and found that only 30 states in the U.S. provide variable Medicaid coverage for hearing aid devices and services and 35 states provide coverage for some cochlear implants and related services. We then conducted a data analysis using health survey responses from the most recent publicly available BRFSS data from 2021. We examined the number of people reporting deafness or serious difficulty hearing, if they have Medicaid coverage, and their employment status. Using the weighted dataset for each state, we created a geographic map of the United States to illustrate the statistics for prevalence of deafness or serious hearing difficulty and Medicaid policy coverage in each state. This study addresses the barriers to health care for people with hearing disabilities and updates previous research.

Elizabeth Michelle Lozoya

Biological Sciences at University of Texas, El Paso

Mentored by Jason A. Wertheim, MD, PhD and Ivan Sarabia (Medicine)



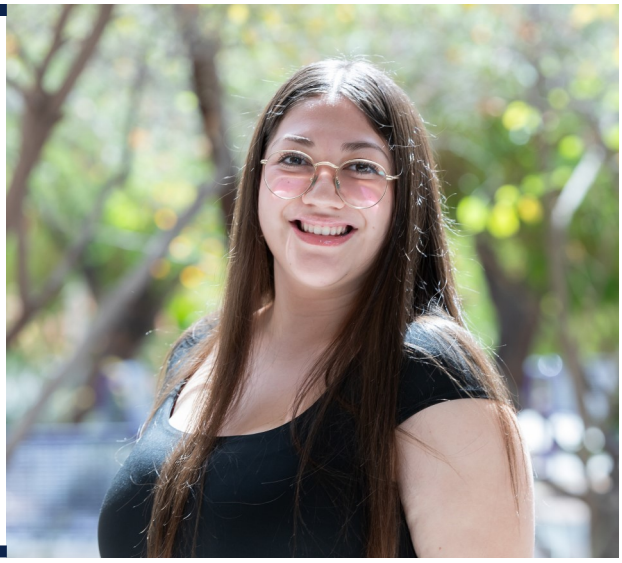
Cell Viability on PDMS gels with tunable stiffness

Polydimethylsiloxane (PDMS) has been used for biomaterial synthesis for many implants, implantable devices, microfluidics, and drug treatments for being a biologically inert material. This means the material won't cause a reaction with substances put on it. The two commercially available PDMS gels are Sylgard 527 and Sylgard 184. The gels vary in many properties, including stiffness. Which is measured with a nano-indenter utilizing Youngs modulus in kPa for elasticity. Sylgard 527 has a stiffness of around 5 kPa and Sylgard 184 has a stiffness closer to 1.72 MPa. For the purpose of this project, we intend to mimic a fibrotic liver which has a stiffness ranging anywhere from 8 kPa to 75 kPa. The specific range intended to accomplish is between 7 to 18 kPa. This will be done by creating a protocol that combines Sylgard 527 and 184 in varying ratios. This will allow us to properly tune these gels to have specific stiffness for growing and testing liver cells. The cells will be tested to identify the properties expressed in the cell when grown on these ranges of gels.

Ayleen Mendoza

Biomedical Science at University of Texas, El Paso

Mentored by Scott Boitano, PhD (Physiology)



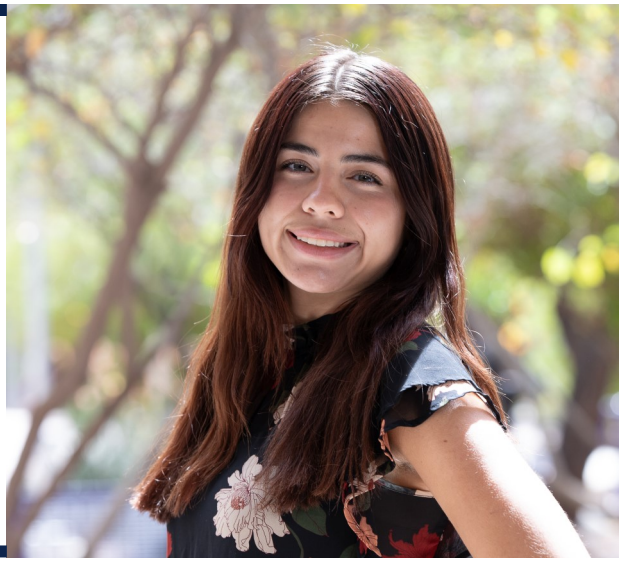
Developing PAR2 Antagonists for Allergic Asthma through Transgenic Mice Models

Asthma is a chronic respiratory disease afflicting the global population. It is characterized by the inflammation of the airways, mucus production, remodeling of the airway wall and bronchial hyperresponsiveness (Hammad, 2021). These changes result in several symptoms including cough, wheeze, shortness of breath and chest tightness. Under extreme circumstances asthma exacerbations can result in death. At present there is no cure for asthma, and common therapeutic options are focused on relieving developed symptoms. We are focused on producing novel asthma drugs that target upstream initiating events in asthma development. Protease-activated receptor-2 (PAR2) is a G protein-coupled receptor that is activated by asthma associated allergens to induce asthma symptoms in pre-clinical asthma models. We are developing and testing novel PAR2 antagonists that can prevent allergic asthma.

Alyssa Moise

Molecular & Cellular Biology at University of Arizona

Mentored by Shanna Hamilton, PhD, Brett Torrel, Rachel Battershell, Sage Quiggle, and Robin Black (Cellular & Molecular Medicine)



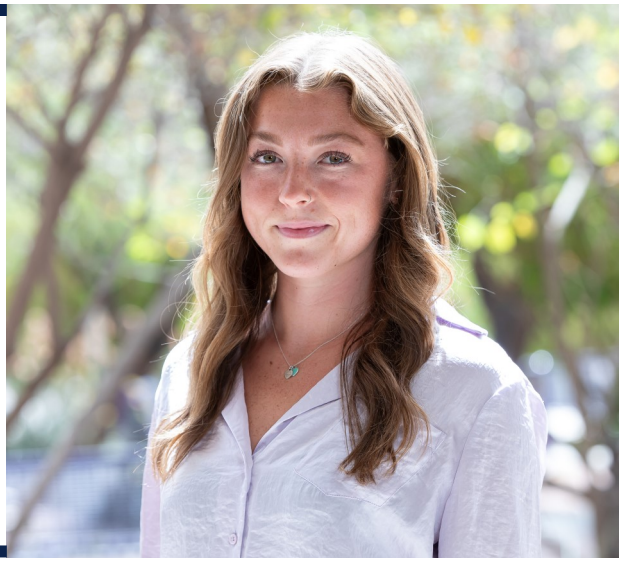
Using Biosensors to Quantify ATP and Calcium Consumption in Cardiomyocytes

The heart is made up of billions of cells, all coordinating together to create a functional organ that is critical to sustaining life. Cardiomyocytes constantly receive specific signals to contract at a distinctive rhythm. Unregulated signals are the foundation for cardiac arrhythmias. Understanding the underlying mechanisms of cardiac signal regulation is crucial to finding new therapies. Two key components in the regulation of cardiac rhythm are adenosine triphosphate (ATP) and calcium (Ca2+). ATP is key to the excitation of Ca2+ channels, like RyR2, causing contraction of cardiac filaments. Cardiomyocytes were previously estimated to use 5-10 mM of ATP during excitation-contraction coupling, while a new study by Rhana et al. 2024 (Proc Natl Acad Sci), used a fluorophore ATP biosensor showing approximately 1 mM in mouse cardiomyocytes. To further characterize this regulation factor, we used this biosensor to investigate ATP and Ca2+ consumption in rat cardiomyocytes and human embryonic kidney cells. In these experiments we demonstrated an increase in fluorescence within transfected HEK cells when exposed to an environment of higher ATP concentration.

Klein Powell

Nutritional Science at University of Arizona

Mentored by Stephen Dahmer, MD and Paula Cook
(Andrew Weil Center for Integrative Medicine)



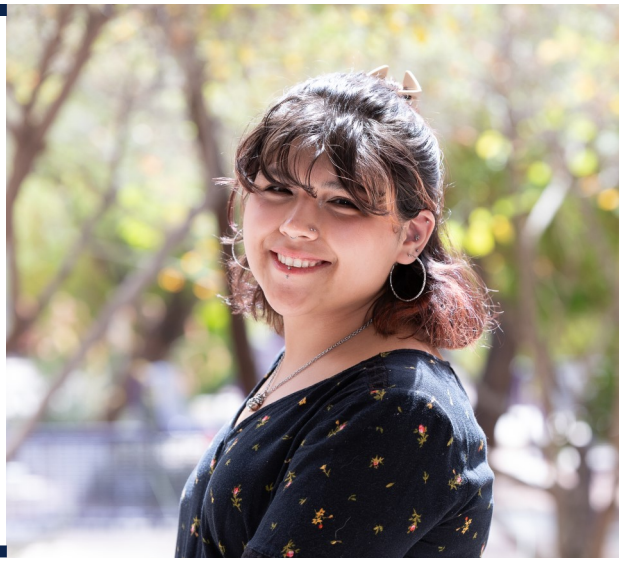
Testing the Feasibility of a Daily Nutrition Choice of 7 Servings of Vegetables, a Handful of Nuts, and a Sprinkle of Extra Virgin Olive Oil

In the U.S., cardiovascular disease is the leading cause of death, and obesity is the second leading cause of preventable death. Nutrition is a primary preventative lifestyle factor proven to decrease the risk of cardiovascular disease, obesity, stroke, diabetes mellitus, arterial hypertension, etc. Fortunately, the consumption of vegetables, nuts, and extra virgin olive oil has also been linked to reduced risk of obesity and cardiovascular disease. Therefore, 7HS, the daily nutrition choice of consuming 7 servings of vegetables, a handful of nuts, and a sprinkle of extra virgin olive oil presents the potential to reduce the risks of cardiovascular disease and obesity. The fiber, omega-3 fatty acids, and cardio-protective compounds bountifully found in these three elements are a simple way to introduce or add nutrient-dense foods to one's diet while highlighting autonomy in other daily food choices. The 7HS protocol aims to test how feasible it is for at least fifteen qualifying individuals residing in Tucson, Arizona to consume 7 servings of vegetables, a handful of nuts, and a sprinkle of extra virgin olive oil daily for fourteen consecutive days. All data will be collected anonymously via phone or a Qualtrics survey. Participants of this study will receive educational handouts regarding the potential benefits of the 7HS approach from evidence-based research, local resources, food and grocery programs, recipes, and tips. As of July 2024, this study is under review by the IRB.

Nico Putnam

Biomedical Sciences at
Rochester Institute of Technology

Mentored by Felicia Goodrum, PhD and Pierce Longmire (Immunobiology)



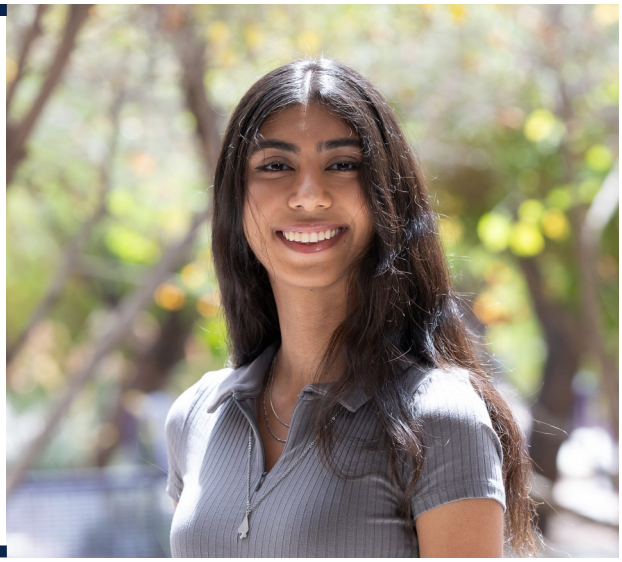
Investigating Interactions between
Human Cytomegalovirus and the Host DNA Damage Response

Human cytomegalovirus (HCMV) is a betaherpesvirus that exists in approximately 40% -100% of the global population as a lifelong infection. Like all herpesviruses, HCMV establishes latency, defined as a virus persisting in the body without producing more progeny virus, or staying dormant within the cell. An estimated 50-85% of adults in the United States are infected by HCMV. Although the majority of infections are asymptomatic, viral reactivation from latency results in increased risk of mortality in immunocompromised populations, such as recipients of organ donations or chemotherapy. UL138, a gene of interest in the HCMV genome, suppresses HCMV replication in order to establish and maintain latency. Previous work has shown that UL138 regulates host cell DNA damage response (DDR) pathways through interaction with host proteins necessary for DNA repair. In this project, our aim was to determine how UL138 uses host DNA repair pathways to establish and maintain viral latency. Specifically, we sought to investigate interactions between HCMV UL138 and non-homologous end joining (NHEJ) and homologous recombination HR) pathways, two major routes for repair of double-strand DNA breaks. In order to determine if UL138 impacts host NHEJ or HR pathways, reporter plasmids for HR and NHEJ were used. Future work will aim to insert these reporter constructs into HCMV-infected cells to analyze UL138 regulation of NHEJ and HR repair pathways. This will allow for further understanding of the interactions between UL138 and host cell DDR pathways and the mechanisms behind HCMV latency.

Rabia Qureshi

Biotechnology at University of Arizona

Mentored by Jesse Woodson, PhD and Cristian Salazar De Leon (Plant Science)



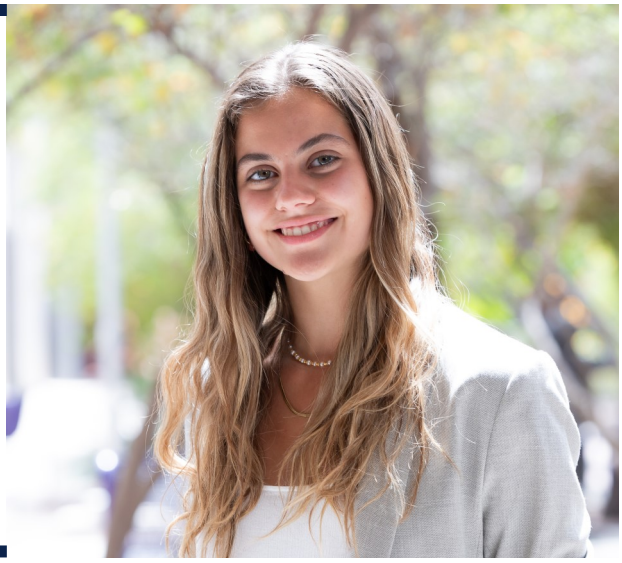
Shedding Light below Ground – Optogenetic Switches in Roots

Light-induced genetic switches, or optogenetics, are an emerging tool in plant biotechnology, allowing for precise control over physiological processes through light-responsive mechanisms. Optogenetics has been successfully applied in bacteria, yeast, and mammal species, but its applications within plants is limited. Optogenetic switches can be controlled by underground LED lights to induce expression of target genes through the root, which can help avoid the issue of expression caused by a plant's natural reaction to sunlight. In this study we investigate plant-specific light inducible genetic switches within the roots, by enabling targeted manipulation of specific proteins and removing the interference of sunlight onto the optogenetic switch system. Optogenetics offers greater benefits than traditional chemically induced gene expression systems such as controllability of gene expression, by bypassing the need to equally distribute the same chemical dosage on all the plants. Another benefit of controllability within optogenetics is being able to turn expression on and off instantly rather than waiting for chemicals to dissipate in order to turn off expression. Optogenetics is also a non-invasive system, there is no worry about water runoff/contamination from chemicals in the soil being transferred to other plant species causing many different environmental issues. The goal of this project is to apply these optogenetic switch systems to improve nitrogen and water usage efficiency and implement them in agriculturally relevant plants. This research work is in collaboration with plant scientists, roboticists, computer scientists, and social scientists at the Center for Research on Programmable Plant Systems (CROPPS).

Irene Maria Ruiz

Neuroscience at Scripps College

Mentored by Todd Vanderah, PhD, Tally Largent-Milnes, PhD and Kelly Karlage (Pharmacology)



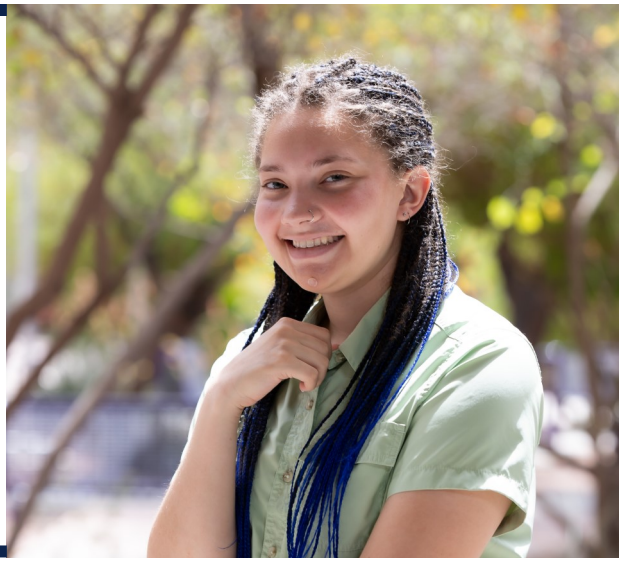
Effect of ABHD6 inhibition on pain-induced depressive behaviors in female mice

Chronic pain is a common condition that affects at least one in five individuals in the United States; 30-40% of which experience neuropathic pain. Over half of all individuals suffering from chronic neuropathic pain also experience moderate to severe depression, known as chronic pain-induced depression (CPiD). However, there are no known effective treatments that alleviate both chronic pain and its resultant CPiD. Therefore, we used a partial sciatic nerve ligation (pSNL) model to cause permanent neuropathic pain in female mice and monitored development of pain and depressive-like behaviors for 29 days. One group was treated with KT-182 (2mg/kg), an irreversible ABHD6 inhibitor, to increase 2-AG (an endocannabinoid) in dopaminergic neurons of the ventral tegmental area with the hypothesis that it will reduce depressive-like behaviors in CPiD-impacted mice; the control group was treated with vehicle. Around 71% of mice that underwent pSNL developed the expected neuropathic pain conditions as indicated by the Von Frey method of measuring mechanical allodynia by Day 7. 42% of mice exhibiting chronic pain also experienced depressive-like symptoms measured by Forced Swim Tests, indicating CPiD. KT-182 had an analgesic effect during days of dosing. Interestingly, the drug seemed to worsen depressive-like symptoms ($p=0.024^*$) in treated mice as compared to vehicle. The complex mechanisms causing CPiD are partially explained by the 2-AG endocannabinoid, which upon increase may alleviate neuropathic pain symptoms. However, further work must be done to uncover the neural pathways implicated in pain-induced depression.

Joselyn Toothaker

Biomedical Engineering at University of Arizona

Mentored by David Margolis, MD, PhD, David Gonzales, Gerardo Figueroa Romero, Robert V. Childers Quiñones, and John A. Szivek (Biomedical Engineering)



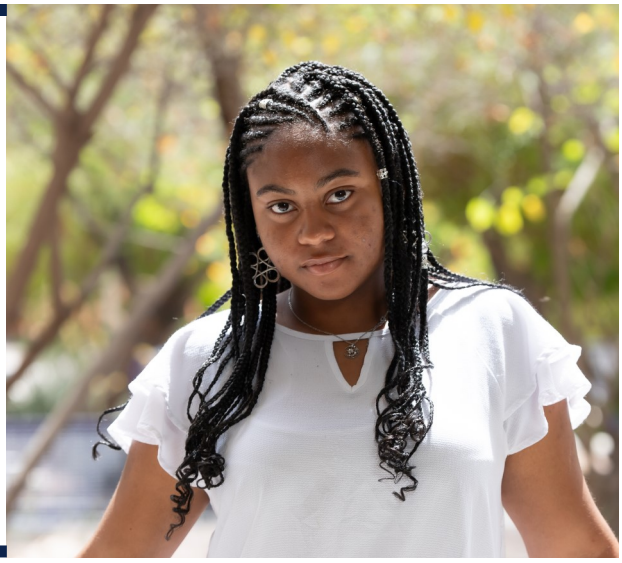
Long Bone Regeneration using Stem Cells Cultured on 3D Printed Scaffolds

Large segmental bone defects that occur as a result of traumatic bone injury or resection due to cancer often do not heal properly. In certain cases, traditional treatment methods have an increased risk of delayed or non-union, and significant risk of rejection or replacement. In order to reduce the probability of an adverse event occurring, utilizing one's own stem cells to trigger the body's innate ability to rebuild bone may be a viable option. Stem cells derived from adipose tissue were extracted. They were then placed on a biocompatible/absorbable matrix that was implanted and growth progress was observed over a period of time before the section of bone was explanted and converted into slides for histological analysis. The purpose of this project is to quantitatively analyze various factors of bone growth, including but not limited to bone area, mineral apposition rate(MAR), and mineralizing surface(MS), of three experimental groups having undergone this type of procedure. The final results will reveal whether tissue engineering, and which type of treatment, is more effective and safer for the long-term health of the individual. While analysis is still in progress, the results so far indicate bone regrowth and remodeling occurs continuously at the defect site.

Zorah Williams

Biology at University of the Virgin Islands

Mentored by Gayatri Vedantam, PhD and Farhan Anwar (Animal and Comparative Biomedical Sciences)



Using Microscopy to Evaluate Antibacterial Drug Activity

Clostridioides difficile (*C. difficile*) is a Gram-positive, anaerobic, spore-forming bacterium that produces toxins and causes diarrhea and colitis. *C. difficile* infects nearly 500,000 people annually in the United States. Current antibiotic treatments cause further disruption to the commensal microbiota, leading to recurrent *C. difficile* infections. These challenges underscore the urgent need for more effective therapies targeting *C. difficile*. In this project, we utilized microscopic visualization to assess drug impacts on *C. difficile*. We compared the effect of two antibiotics (novel Drug A and the glycopeptide vancomycin) on *C. difficile* using phase contrast microscopy and Gram's staining. We first assessed the effect of vancomycin on *C. difficile* morphology. In a dose-dependent manner, vancomycin-treated cells displayed distortion of their normal rod shape, with rough, punctate morphology. These cells also lost the ability to retain the Gram's stain, and thus appeared Gram-negative. Exposure to Drug A also resulted in a Gram-negative phenotype, suggesting the drug impacted the same aspects as vancomycin. However, phase contrast microscopy of Drug A-treated bacteria revealed normal cell morphology, but significant impact on distribution of intracellular material visualized as irregular phase-dense puncta. Taken together, our data suggest that both vancomycin and Drug A perturbs *C. difficile*, ultimately impacting cell wall components. However, the mechanism(s) underlying this remodeling are likely unique, since novel Drug A exerts drastic impacts within the cytoplasm. Our study highlights the utility of a cost-effective, simple microscopic approach to rapidly evaluate drug impacts on bacteria and underscores the importance of visual tools for assessing antibiotic activity.

UROC-Prep

Program Coordinator: Leah Callovini, MS
Instructor: Leah Callovini, MS
Graduate Teaching Assistants: Melinda Willet Struyk, MA, ABD and Lidia Azurdia Sierra, MPH

Ruth Dierdorff

1) Physics 2) Mathematics at University of Arizona

Mentored by Weigang Wang, PhD, Ali Habiboglu, and Brecken Larsen (Physics)

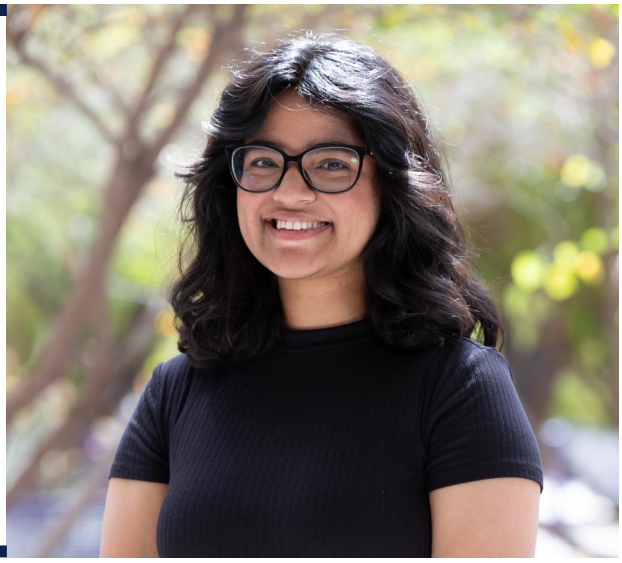
Spin-Orbit Switching in All-Antiferromagnetic Tunneling Junctions

Antiferromagnetic materials resist external magnetic fields, exhibit ultrafast spin dynamics, have no stray fields, and occur frequently in nature (Wadley et al., 2016). Recently, researchers have used non-collinear antiferromagnetic electrodes to create functioning magnetic tunnel junctions (MTJs) that use spin-orbit torque (SOT) switching (Shi et al., 2023). Furthermore, the recent discovery of intrinsic SOT switching in non-collinear antiferromagnetic thin films suggests that intrinsic SOT could be a viable switching mechanism for PtMn-based MTJs (Chen et al., 2024; Deng et al., 2023). In this study, we sputter deposited Pt/PtMn/MgO/PtMn/Pt MTJs on Si wafers with a range of Pt in the buffer layer, where MTJs with 1–5 nm of Pt use SOT switching of Pt and MTJs with 0 nm of Pt use intrinsic SOT switching of PtMn. We examine the effect of the Pt size on the percent of switching samples and their tunneling magnetoresistance (TMR). Both SOT MTJs and intrinsic SOT MTJs yielded large TMRs. Furthermore, we explore the effect of the annealing temperature on the percent of switching samples and their tunneling magnetoresistance. By investigating these questions, we can continue optimizing the performance of antiferromagnetic MTJs to develop the future of computer memory.

Shaakshi Dubey

Veterinary Science at University of Arizona

Mentored by Marc Orbach, PhD and Lisa Shubitz, DVM (Valley Fever Center for Excellence)



Yeast Phase Growth Studies for Blastomyces dermatitidis and Histoplasma capsulatum

Dimorphic mammalian fungal pathogens are pathogens that can cause severe respiratory distress and have two different cell morphologies. The hyphal phase produces filaments that grow outward on its substrate in the environment while the yeast phase, consisting of spherical cells, occurs in the host. Currently, a Valley fever vaccine is under development at the University of Arizona. The vaccine consists of an avirulent *Coccidioides* mutant strain, called *Δcps1*, which is administered as a live-attenuated vaccine. The goal of my summer project was to produce yeast phase cells of *Histoplasma capsulatum* and *Blastomyces dermatitidis* to test whether vaccination of mice with the *Δcps1* vaccine can provide cross-species protection against B. *dermatitidis* or *H. capsulatum* disease. To produce yeast phase cells, they must be grown at 37oC on growth media. Preliminary studies showed that different media produced different cell morphologies and growth rates for *H. capsulatum* and *B. dermatitidis*. The results demonstrate that yeast phase cells were most prevalent in Middlebrook 7H10 media for *B. dermatitidis* at 92.4% grown for 4 days and Ham's F-12 modified media for *H. capsulatum* at 82.5% for 8 days. When working with human pathogens in a biosafety cabinet at Biosafety level (BSL) 2 or BSL3, safety is critical to avoid exposure to the pathogens. A study was conducted to determine the effectiveness of using 70% ethanol as a disinfectant for killing *B. dermatitidis* and *H. capsulatum.* Quantitative studies performed determined that both fungal pathogens are killed by 70% ethanol after exposure for 5 minutes.

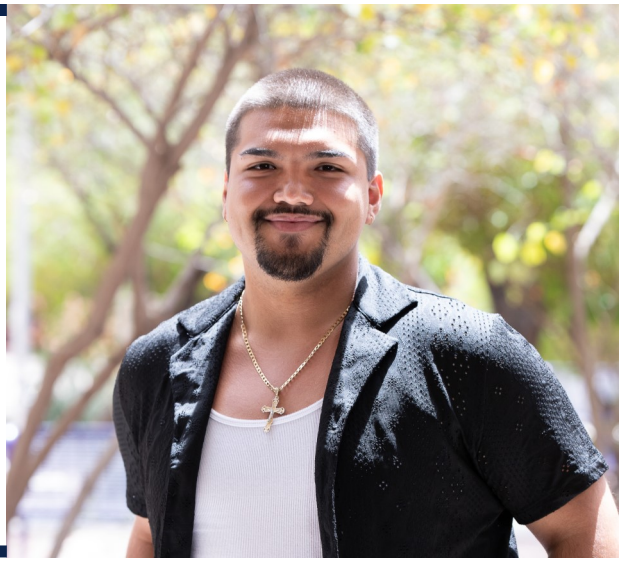
Summer Research Institute (SRI)

Program Coordinator: Tianna Urrea MacMeans
Instructor: Leah Callovini, MA
Co-Instructor: Tianna Urrea MacMeans
Graduate Teaching Assistants: Sergio Castro and Nathaniel Gallegos
Sponsors: University of Arizona Graduate College and Western Alliance to Expand Student Opportunities (WAESO)

Julián G. Ángel

1) Chicana and Chicano Studies 2) Latin American Studies at University of New Mexico

Mentored by Ruth M. López, PhD (Educational Policy Studies & Practice)



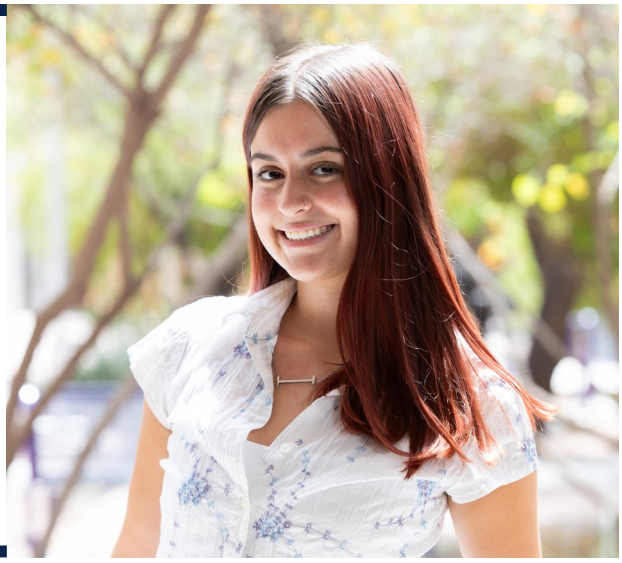
Serving Beyond Citizenship:
A LatCrit Policy Analysis of Proposition 308 at Arizona Hispanic-Serving Institutions

Proposition (Prop.) 308, passed in 2022 in Arizona, grants undocumented immigrant students in-state tuition rates at public institutions and access to state-based aid, such as scholarships. In this research project, we will explore Prop. 308 and its impact on undocumented students attending Arizona's Hispanic Serving Institutions (HSIs). Guided by LatCrit Policy Analysis we seek to answer the research question: How has Proposition 308's institutional implementation at Arizona HSI's supported undocumented students? To address this question, we will first review federal policies aimed at supporting the educational trajectories of undocumented students. We will then compare state aid policies across various states to understand Arizona's unique policy terrain in serving undocumented students. By utilizing and analyzing publicly available information (media, policy, and institutional) about Prop. 308 we will suggest policy recommendations to support higher education leaders, practitioners, K-12 educators, and community organizations in navigating the implementation of Prop. 308. Centering the importance of intersectionality within HSIs (Garcia & Cuellar, 2023), this research is crucial due to Prop. 308's recent implementation. Our findings can guide institutional policies to better serve undocumented students at HSIs.

Inessa Brenes

Psychology at University of Arizona

Mentored by Arne Ekstrom, PhD and Paul Miller, PhD (Psychology)



Assessing the Construct Validity of Two Measures of Memory Precision

Impaired episodic memory, or memory for unique events in time and space, is. a hallmark of various psychiatric and neurological disorders. Laboratory-based assessments of episodic memory often operationalize memory outcomes as binary (e.g., remembered vs. forgotten) and may miss out on subtle differences in the precision or fidelity of details retrieved from memory. In the present study, participants completed two behavioral tasks that have been proposed to measure memory precision: the Mnemonic Similarity Task (MST) and a continuous response Item-Location Memory Task. The MST requires participants to study pictures of everyday objects. During a subsequent test phase, participants were presented with previously studied objects (targets), perceptually similar objects (lures), and new objects (foils). Participants were instructed to identify each object as "OLD," "Similar," or "New". We computed a Target-Lure Discriminability Index which captured the ability to distinguish between perceptually similar lures and previously studied targets. In the Item-Location Memory Task, participants used a continuous analog scale to reconstruct the locations of objects on a circular display. Distance error between the remembered and true location of the item as a measure of memory precision. We compared performance between the respective tasks evaluate construct validity. Provisional results indicate a negative association between measures of memory precision from the two tasks. By clarifying the validity of these tasks, we hope to enhance our understanding of memory processes and provide insights into cognitive differences in psychiatric and neurological populations, ultimately contributing to more effective assessment and intervention strategies for memory-related conditions.

Jennifer Conley

Ecology & Evolutionary Biology at
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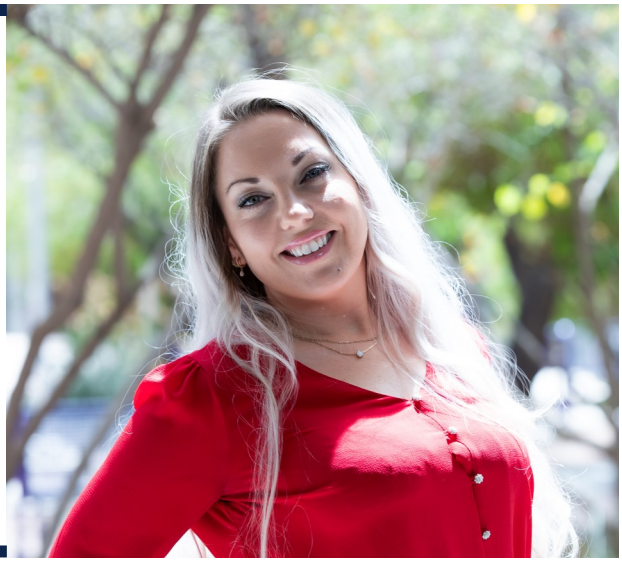

Molecular Detection of Cyclospora cayetanensis in Southeast United States Irrigation Waters

Cyclospora cayetanensis, a human- specific protozoan parasite, causes cyclosporiasis via contaminated produce. Irrigation waters are believed to be an agent in transmission of oocysts, but this remains poorly understood. This study aims to confirm the presence of *C. cayetanensis* in irrigation water samples from the Southeastern U.S. fresh produce growing regions. Water samples (10L) were collected (n=288) using the Rexeed-25S Dead-End Ultrafilter followed by DNA isolation using the Food and Drug Administration's (FDA) Bacteriological Analytical Manual (BAM) Chapter 19c protocol. Molecular detection targeted both 18S rRNA and Mit1C. Real-time Polymerase Chain Reaction (qPCR) showed 135 samples positive for *C. cayetanensis* with the 18S rRNA target and no positives with Mit1C. To address conflicting results, 105 of the 135 samples were sequenced using Oxford Nanopore Technologies MinION platform. Three biomarkers were utilized for sequencing: 18S rRNA, CDS-3, and Mit3PCR. CDS-3 and Mit3PCR were used as secondary confirmation markers specific to *C. cayetanensis*. PCR amplification, followed by gel electrophoresis and library preparation using the rapid sequencing DNA V14 kit (SQK-RBK 114.96), was performed. Out of the 50 samples sequenced so far, 18 resulted in BLAST confirmation for *C. cayetanensis* with 55 samples left to sequence. The 18S rRNA sequencing revealed one positive and six instances of cross-reactivity (*Eimeriidae* or *Dinoflagellate*). CDS-3 identified 7 positives, aligning with 2 of the 4 Mit3PCR positives. Notably, none of the Mit3PCR and CDS-3 positives matched the 18S rRNA positives. This underscores the importance of sequencing alongside qPCR for accurate detection of *C. cayetanensis* in water samples.

Sergio Demara

Molecular & Cellular Biology at University of Arizona

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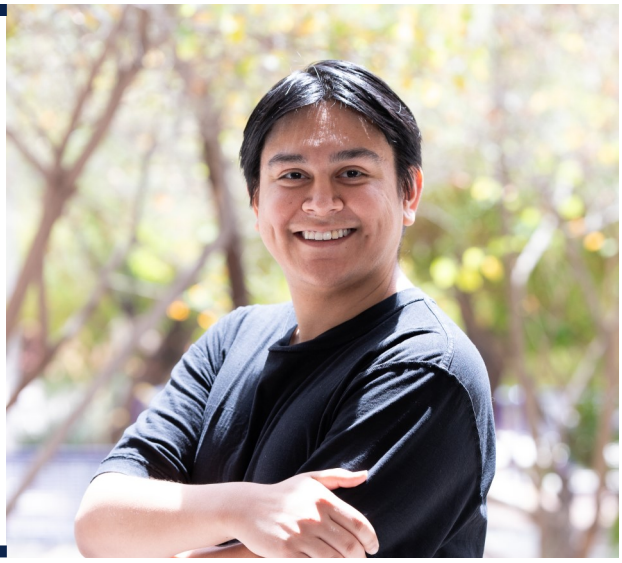

Proteomics of the Long COVID-19 AZ HEROES Study

The Arizona Healthcare, Emergency Response, and Other Essential Workers Surveillance (AZ HEROES) Study investigated proteomic profiles of frontline workers infected with long COVID (LC) and normal COVID across three time points of infection. This project identified 62 proteins for dysregulation and function within the context of LC and COVID, and analyzed the relevance of these proteins for alcoholism and the neutrophil extracellular trap formation/NETosis pathways. Among these, 12 proteins linked to the alcoholism pathway were identified, including Interleukin-18, which recruits neutrophils to the intestine and lungs following alcohol consumption, and glucagon which diminishes liver regeneration in fasting states upon alcohol exposure. The study examined health effects related to LC's impact on the differential proteins, like thyroglobulin (Tg), linked to long-term thyroid dysfunction in post-COVID infections by increasing autoimmune attacks on Tg. Transcription factor PU.1, necessary for interleukin-9 (IL-9) production, experiences dysregulation upon COVID infection by upregulating IL-9, causing increased respiratory inflammation. Another example is guanylate-binding protein 2 which may successfully inhibit Omicron and Wuhan-Hu-1 strain infections but proves to be ineffective against Alpha and Delta strains of COVID. Some proteins may serve as biomarkers to infer the presence, prognosis, or severity of COVID infections including dickkopf-like protein 1 (DKK-1) and clathrin light chain A. Proteins including trefoil factor 1, vimentin, glucagon, leukotriene A4 hydrolase, and DKK-1 are possible targets in COVID-19-related therapeutics. This study furthers our insight into proteomic changes in frontline workers from LC infection and suggests proteins as therapeutic targets or indicators of prognosis and associated diseases.

Keywords: proteomics, COVID

Kieran Douglas

Economics at University of Arizona

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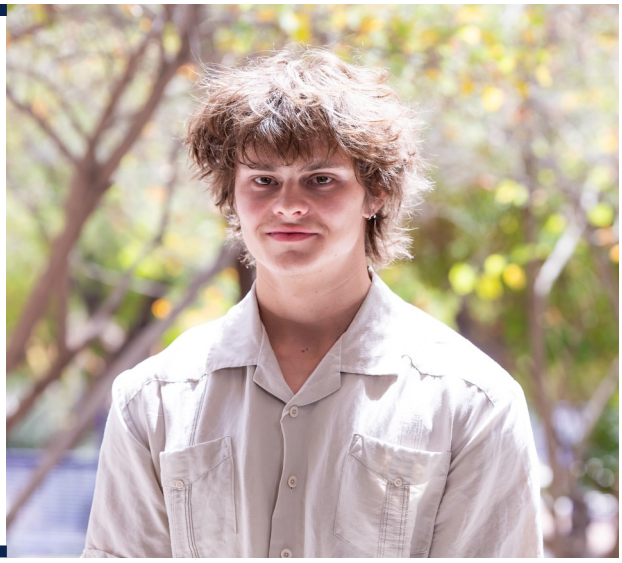

Exploring Complications With Instrumental Variable Selection and Their Solutions

The highly dynamic and complex nature of the world can make it exceedingly difficult to create models that accurately and precisely measure its contents in consistent and reliable ways. Flaws in popular modeling techniques can lead to a large volume of research that relies on shaky assumptions and may contain severe validity problems. Critiques of Instrumental Variables Regression (IV) have spawned skepticism regarding their application throughout the social sciences. This has led to a rich area of literature which investigates the use of IVs in economics and develops certain criteria and techniques by which researchers can select their IVs in hopes of avoiding validity problems. I explore the use of a wide variety of weather metrics as IVs and the extent to which they may have validity problems by developing a script that extracts information from a large quantity of academic papers. Using the Large Language Model ChatGPT, my project aims to provide a proof-of-concept for a new method of data collection and analysis that has the potential to significantly accelerate the research process and broaden the scope of what is attainable when it comes to work that pulls from a broad selection of existing literature.

Adam El Houmaidi

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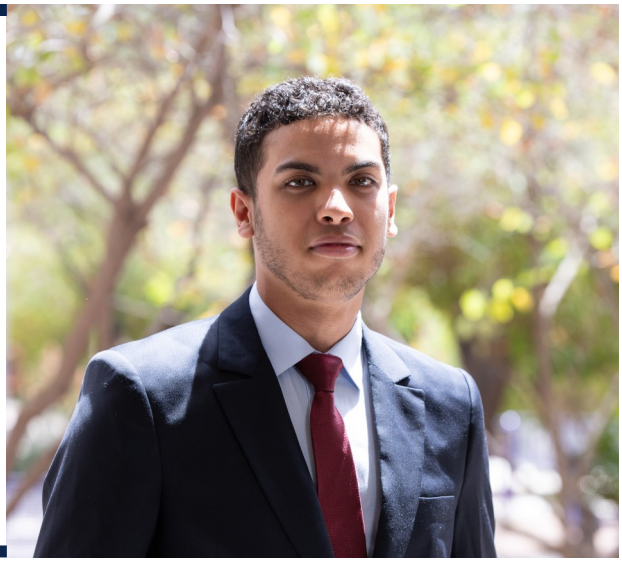

Shock Tube Analysis: Step Response of a Quad-Sensor Configuration

This study investigates the step response of four sensors installed in a shock tube: PCB132 and Kulite XCE-062 for pressure measurements, and Ahmic and CUBRC for heat flux/temperature measurements. Due to time and logistical constraints, only the Kulite and an Omega pressure sensor were utilized. The shock tube experiments were conducted with a sampling frequency of 1 MHz, capturing detailed pressure profiles during two runs. The Kulite sensor was connected to a specialized data acquisition card featuring resonance compensation, a technology designed to mitigate oscillations caused by sensor-diaphragm resonance and reduce distortions in pressure readings following a shock wave. One run was performed without activating this feature, while the other utilized it, allowing for a direct comparison of its effects. Voltage signals from the sensors were converted to pressure readings, and initial and final conditions of the driven section were analyzed. Key parameters such as driver pressure and wave timing were calculated to understand the shock dynamics. Step responses were isolated and analyzed using Welch's method to estimate the power spectral density, yielding smooth and accurate frequency responses. Comparative analysis revealed that resonance compensation effectively reduces high-frequency oscillations, resulting in a smoother frequency response curve. Notably, the compensated step response showed less negative overshoot, indicating improved accuracy in pressure measurements immediately following the shock wave. This research demonstrates the importance of advanced signal processing techniques and sensor technologies in accurately capturing and analyzing shock waves, contributing valuable insights to the field of fluid dynamics and heat transfer in high-speed flows.

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Counseling & Community Psychology at
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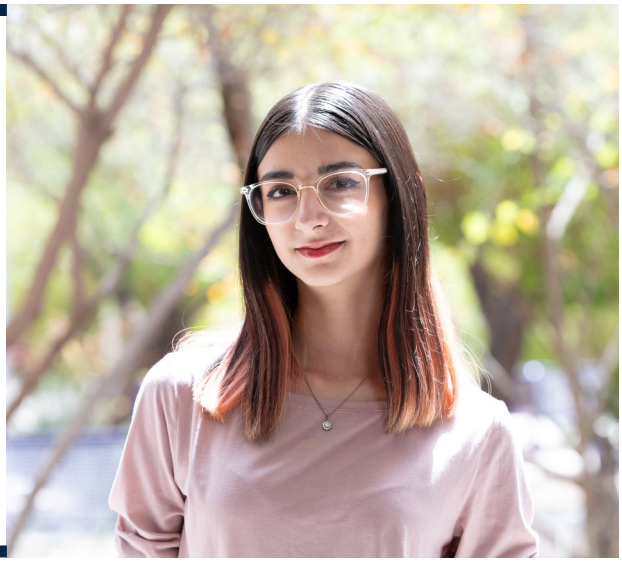

A Website Analysis of Culturally and Linguistically Appropriate Opioid Use Disorder Prevention Services in Rural Arizona

According to the Arizona Department of Health Services, there were 1,928 opioid deaths in Arizona in 2023. Opioid Stewardship Programs were created to support the appropriate prescribing, management, and disposal of opioids for the treatment of pain. Although these programs are supported by the American Hospital Association, they remain underutilized. In this study, I assessed whether there is a need for and capacity to implement OSPs in rural healthcare. I randomly selected 3 healthcare organizations from the Arizona Center for Rural Health Safety Net Map from 3 rural counties. I used a review guide for each website, which included cultural and linguistic standards (CLAS) as created by the U.S. Department of Health and Human Services, 23 possible services, and principles of addiction treatment. Additionally, I assessed whether outdated or potentially stigmatizing words associated with substance use were present. The findings demonstrate variability among healthcare organizations in communicating CLAS Standards, and chronic pain and addiction services and principles. It also demonstrates gaps in opioid use disorder prevention and treatment. There was little evidence of potentially stigmatizing or outdated vocabulary on these websites. Given these findings, this research can serve as a guide for future actions taken by healthcare directors. For example, future public health research could focus on studying how, or if at all, websites have a relationship to service access.

William Hiroaki Grobe

Mechanical Engineering at University of Arizona

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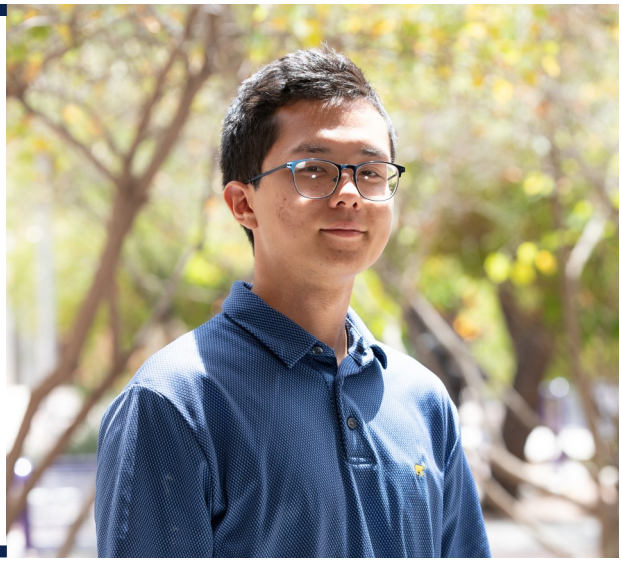

Planning Unmanned Missions to Mars

Space has the potential to open countless scientific opportunities, our biggest limits being money and technology. It is important to develop countless concept missions as a way to understand the motivations of the scientific community, assess technological capabilities, and determine potential costs/funding options. Led by Dr. Jekan Thangavelautham, my group and I developed a concept mission to Mars. This mission was designed around the system architecture of the FemtoSat, a subclass of satellite that weighs less than 100 grams, and measures 3 x 3 x 9 cm. One of the unique benefits of the FemtoSat is that it uses commercial off-the-shelf parts (COTs). That, combined with its low mass, means that it can be launched into deep space for around $80,000. The mission, Surface Temperatures and Observation Recording on Mars (STORM), has the goal of taking weather data for a duration of one Martian year. This data would then be transmitted back to Earth through the Martian Reconnaissance Orbiter (MRO) for analysis. The data can then be used to further understand Mars' climate history, and through it our own history. Even if this mission doesn't make it past the planning stages, it is still a valuable exercise in space system design. By using COTs, an analysis of the current technologies can be performed. This is especially important due to NASA's reluctance towards using new technology in their missions. The ability to test brand new technologies in space will open the door for faster, better space missions.

Fran Lopez

Sociology at University of New Mexico

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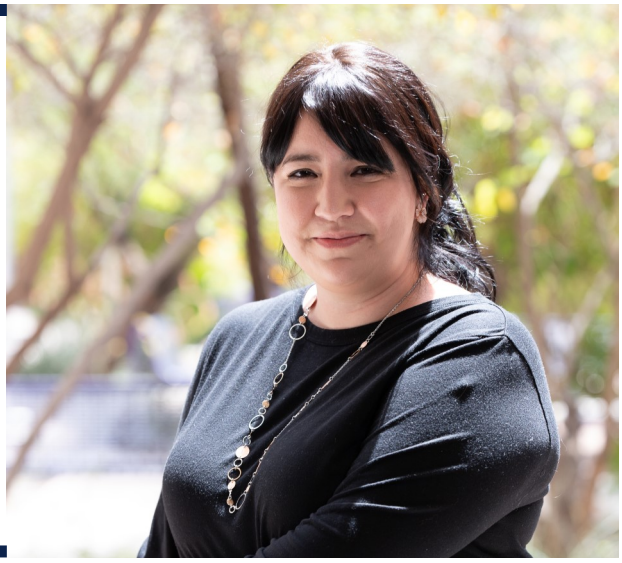


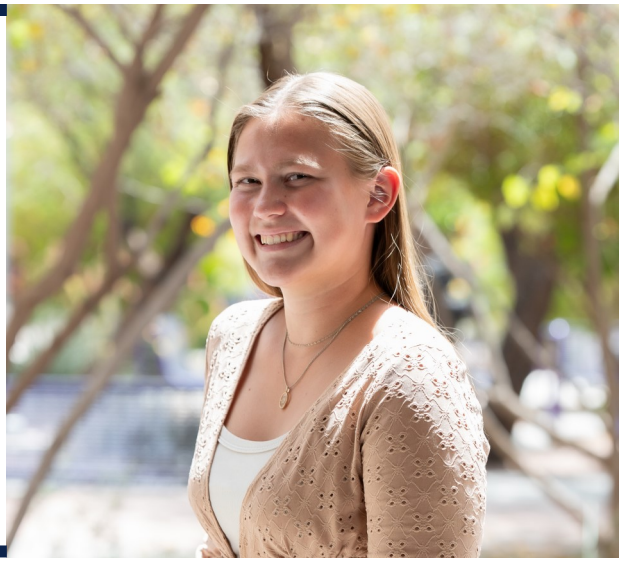
Building Bridges, Not Walls: Communicating Across Political Divides for a United Future.

Abstract: This study was conducted to determine the nature of communication amongst political polarization, incorporating perspectives from social capital, intergroup contact theory, as well as insights from neurology, sociology, culture, and psychology. In a nation marked by increasing divisions, understanding the roots of diverse political beliefs and promoting effective dialogue is crucial for societal unity and advancement. Through an interdisciplinary approach, this study examines how social capital can facilitate communication between individuals with contrasting political views, exploring the roles of trust, reciprocity, and shared norms in bridging ideological gaps. Utilizing intergroup contact theory, the research investigates how direct interactions between individuals of different political affiliations can mitigate prejudice and nurture empathy. By identifying optimal conditions for breaking stereotypes and fostering positive attitudes, this study aims to uncover strategies for promoting constructive discourse. Moreover, this research explores the neurobiological foundations of political beliefs, analyzing how cognitive processes and emotional responses influence individuals' political perceptions. By integrating neuroscientific insights, the research seeks to illuminate the neural mechanisms behind ideological differences. Drawing from sociological, cultural, and psychological perspectives, this study also examines the social, cultural, and psychological factors shaping individuals' political ideologies. By examining the influences of socialization, group identity, media exposure, and cognitive processes, the research aims to provide a comprehensive understanding of the complexities surrounding political beliefs.

Calista Madej

Molecular & Cellular Biology at University of Arizona

Mentored by Solange Duhamel, PhD and Nathan Hadland (Molecular & Cellular Biology)



Analyzing Transitional Lava Textures and Porosity for Biomarker Detection: Insights from the 2014-2015 Holuhraun Eruption as a Martian Analogue

As the search for past or present Martian life continues, efforts to identify environments with the highest potential for detecting biomarkers remains a major focus of research. Scientists are focusing on analogue environments, places on Earth that share similar qualities with planetary bodies. The Holuhraun eruption from 2014-2015, an analogue for Mars, has been widely used to refine strategies for sample selection on the red planet. While certain microenvironments within basaltic glass have been well documented (Voigt et al., 2021), there is little information on how porosity impacts the biomass of these samples. This project aims to analyze transitional lava textures and their porosity to determine total biomass, ATP volume, and microbial community organization. Sixteen lava samples were collected from the Holuhraun eruption flow field. DNA was extracted from the crushed samples, and the total concentration was measured to determine biomass. The samples were also used for ATP readings. A preliminary procedure was performed to stain a test basalt with osmium, followed by CT scans to create detailed 3D images of the vesicles. The initial CT scans were successful, and the next steps involve visualizing the osmium staining within the pore spaces. Results from biomass readings showed that slabby and fractured basalts had the highest dry biomass, suggesting these textures should be prioritized on Mars for biomarker detection. The ATP results mirrored the biomass readings. These insights will enhance sample selection strategies on Mars, aiding in the search for evidence of past or present life.

Samantha Quintana

1) Health and Society 2) Education at Beloit College

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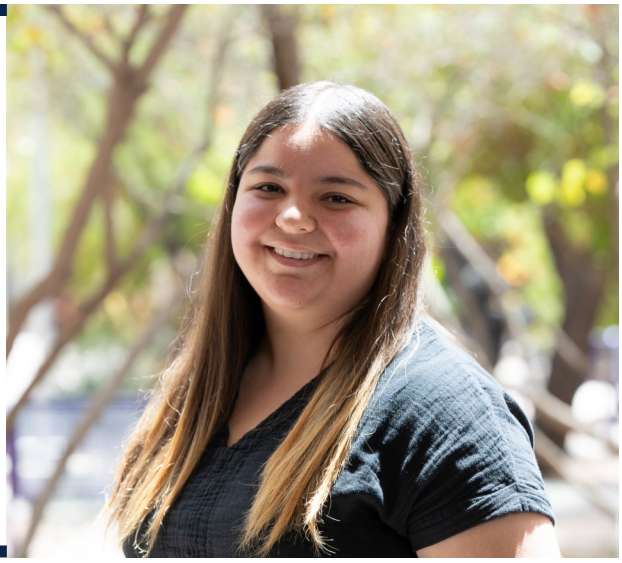

Farmworker Health Equity: An Analysis

Community-driven participatory research in the borderland farm working communities is a cooperative process. The current study aims to develop an intervention that addresses structural issues within the farmworker community to improve farmworkers overall health and wellbeing. The community has a multi-stage assessment of needs: 1) intercept survey, 2) listening sessions, and 3) policy and practice scan at federal, state, and local levels. The analysis tools include focal points of housing inequity, workplace safety, and medical care. Screening tools indicated improvements were needed in all categories, with an emphasis on improvement within healthcare access and atmospheric safeties in housing. The community works together to use the results to implement equitable intervention opportunities to improve health with a high efficacy level and consistent feedback.

Carlee Rautanen

Psychology at University of Arizona

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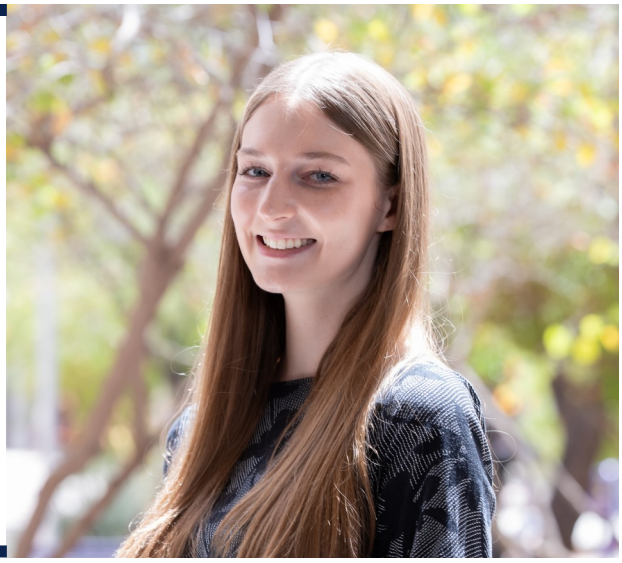

Conflict Discussions and Memory Recall in the Context of Romantic Relationships: A Preliminary Linguistic Analysis

Observational research demonstrates that romantic partners' behaviors during conflict discussions, including the language people use to describe their experiences, are associated with relationship satisfaction and quality. In this context, the study of language presents a window into studying relationship dynamics more broadly. An important related but understudied question in this area centers on the ways in which people recall these discussions. Is the language people use to recall a disagreement with their partner also predictive of their relational well-being? Could memory recall be more predictive than the content of the actual disagreement? To explore this 32 participants who are all in monogamous relationships, as part of a larger study, engaged in recorded disagreement discussion and recall tasks and answered questionnaires exploring relationship satisfaction and depression. The transcriptions of the tasks with a word count greater than or equal to 200 words, were analyzed using Linguistic Inquiry and Word Count (LIWC-22). We hypothesized that recalling the conflict-solving discussion with more positivity than expressed during the actual discussion would be positively correlated with relationship quality, whereas recalling the conflict discussion with more negativity than expressed during the discussion would be negatively correlated with relationship quality. Upon analysis we found significant differences in positive emotion between language indicators during the discussion and recall task, but no significant relationship between these indicators and romantic relationships. Further investigation would benefit from a larger and more diverse sample set which would provide a more in-depth analysis of the associations between memory recall and romantic relationships.

Alysse Razo

Psychology at University of Arizona

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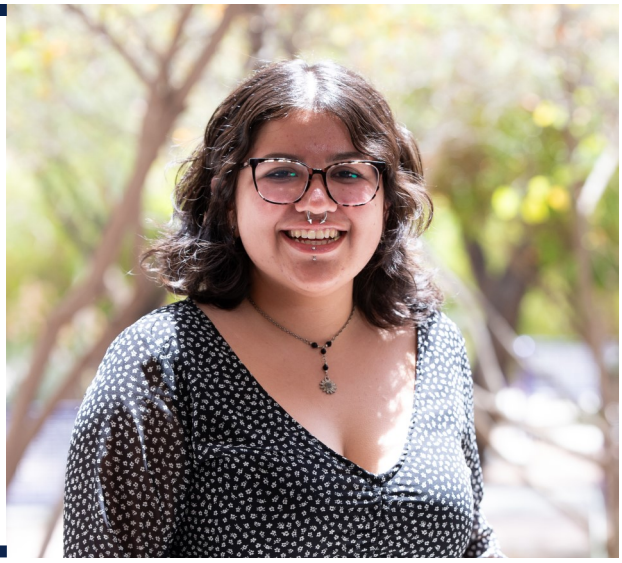

Exploring the Potential Relationship Between the Cycle of Incarceration and Homelessness

This literature review explores how the cycle of incarceration intersects with homelessness in the United States. It examines the relationship between incarceration and homelessness and the factors at play, including crime as a financial means, mental health issues, and inaccessibility to housing. These contributing factors result from practices and policies that enable individuals to be overlooked, become trapped in the cycle, and potentially remain stuck. The criminalization of homelessness and its associated behaviors is a major issue in the current political climate. Analyzing the findings of various studies and reports, it becomes evident that there is an interrelationship between the cycle of incarceration and homelessness. Homelessness and the cycle of incarceration are significant social issues that require the implementation of effective policies and practices that support affected individuals. Additionally, most of the relevant literature was published at least a decade ago. The lack of recent literature indicates a need for updated research that reflects current trends, challenges, and potential interventions. Addressing this interrelationship through updated research and directed policy is necessary for breaking the cycle, effectively putting an end to both homelessness and the cycle of incarceration.

Jason Sanchez Hernandez

Economics at University of New Mexico

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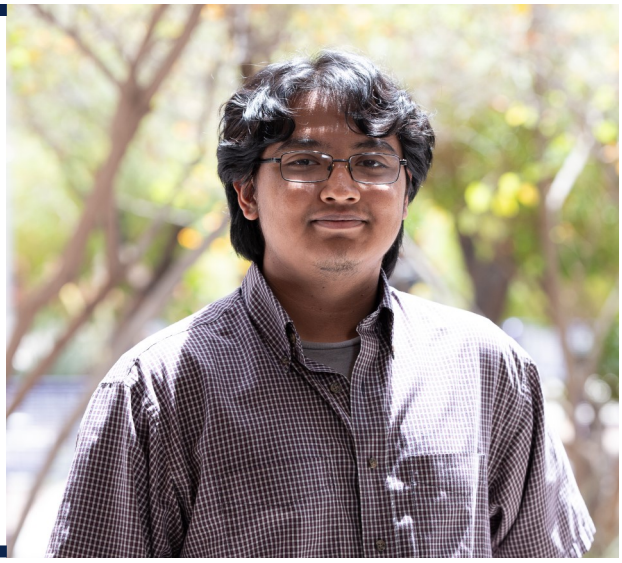


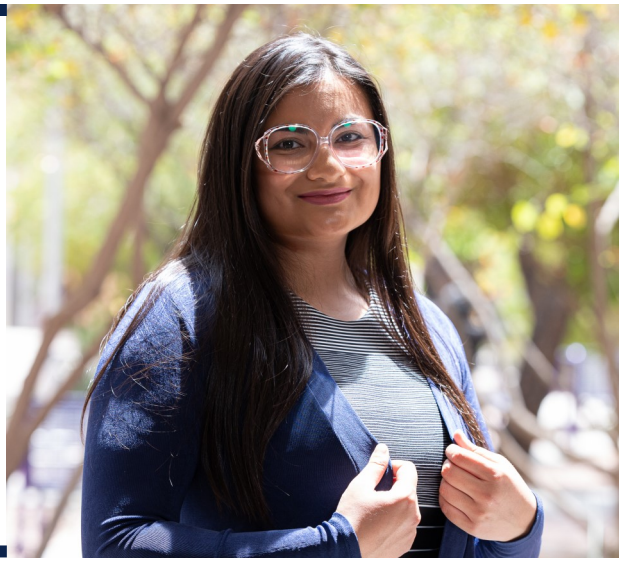
Measuring Risk Preferences: An Ethiopian Study

When it comes to an individual's decision-making process, they have predetermined economic preferences that play a role of influence in said decisions. The ability to measure and predict these economic preferences is crucial as it may assist in predicting economic behavior. This study focuses on a gender comparison analysis of risk preferences among the residents in a working-class neighborhood in Ethiopia, where participants answered an array of questions that covers; incentivized risk games, hypothetical job questions, and ranking their perceived risk preferences. There was an analysis on the correlations between the hypothetical risk preferences, hypothetical job questions, and their switch on incentivized games, then comparing these correlations between men and women. It was found that all correlations were found to be statically significant at the .01 and .05 level for women, as opposed to men that only had statically significant correlations pertaining to their switch rate on incentivized games. Our results also show that men and women's risk preferences are similar with a notable difference in the 'Hypothetical Job Questions', where there is a statically significant result of men showcasing more risk. This result is similar to other risk-taking research discussing differences among men and women in the field, with men being more risk loving, and this study builds on those findings. We conclude that further research is warranted to explore the economic preferences differentiation between men and women.

Jade Z. Serna

Biology at University of New Mexico

Mentored by Janet L. Funk, MD (Medicine)



Creating Clinically Relevant Human Xenograft Models of Bone-Disseminated ER+ Breast Cancer

Eighty percent of women with breast cancer have estrogen receptor positive (ER+) tumors. For this project, the goal was to create a clinically relevant human xenograft ER+ model of breast cancer bone metastases (BMET). Prior models used skeletally immature cycling mice, so the effort became to generate a model more representative of women diagnosed with ER+ breast cancer, who are typically postmenopausal. Prior model results using skeletally immature mice with their ovaries intact were compared to skeletally mature mice with or without ovaries intact (+/- ovariectomy, OVX). With these conditions, the mice were injected with human breast cancer cells, and the resulting tumors and cancer cells were analyzed radiographically and histologically. Mice when compared to humans have significantly lower endogenous estrogen levels, and require E2 supplementation experimentally to sustain human ER+ breast cancer cells. The dosage of estrogen used was also lowered in the mature mouse models. The findings were aligned with what the laboratory largely hypothesized based on prior data and demonstrated that mature mice treated with lower E2 doses had smaller osteolytic lesion sizes and lower incidence. An unexpected result was that the BMETs demonstrated lower incidence and smaller sizes in the OVX mice. This finding was recapitulated in primary tumor mouse models suggesting that the protective effects of OVX lacked bone specificity. Alongside proving the concept that more clinically relevant ER+ BMET models are possible, this project also implies that OVX models reduce reproductive hormones (excluding E2) that could be driving ER+ tumor progression.

Evamaria Tanori Contreras

Neuroscience and Cognitive Science at
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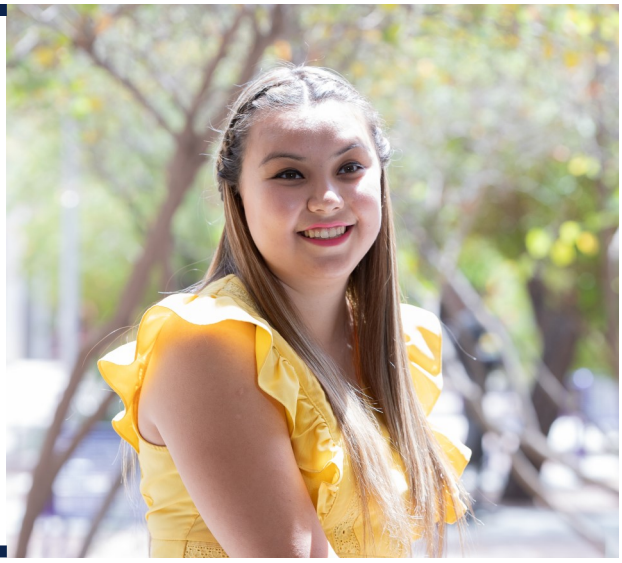

Down Syndrome: A Review of the Barriers to Accessing Early Intervention Resources

Down Syndrome (DS), or trisomy 21, is one of the most studied genetic disorders. Alongside distinctive physical features, DS results in motor, speech, and other cognitive impairments. Early intervention (EI) provides vital resources for children with this diagnosis, mitigating future deficits, and improving quality of life. This research focused on defining the most common barriers to accessing EI for developmental disabilities, including DS, across the literature. The literature revealed disparities in race/ethnicity, state policy criteria, socio economic situations, geographic locations, and insurance type. The most apparent barriers appeared in state policy qualification criteria, which varied from state to state. A comparison of data from both the United States and Arizona demonstrated similar barriers. Before DS received designation as a qualifying diagnosis in 2022, children qualified through other developmental delays. This resulted in children with DS receiving EI resources when other developmental delays presented, reducing the positive effects of EI. More time and data collection are needed to understand the effects of the policy change to EI access in Arizona, ensuring timely access for children with DS, and maximizing their potential.

Ana Tuba

Aerospace Engineering at University of Arizona

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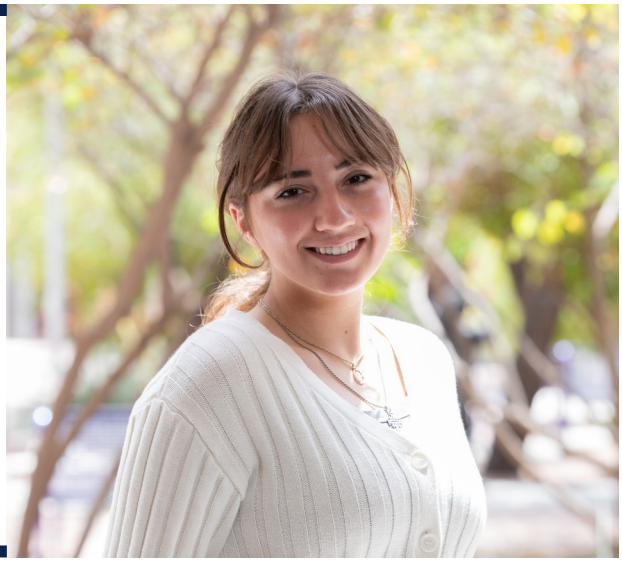


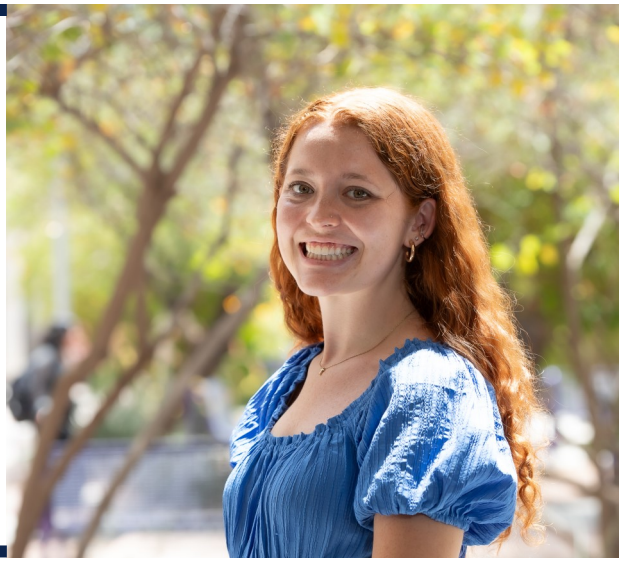
Simulating Hypersonic Flows

Hypersonic flows can be defined as flows in which a set of phenomena become more significant with increasing Mach number. These phenomena include thin shock layers, an entropy layer, high temperature flows, and chemically reactive flows. In the design of hypersonic vehicles, such as those used in space missions, the ability to accurately simulate changes in the flow is important for ensuring their safety and success. These simulations are created through the use of computational fluid dynamics (CFD), which uses numerical methods to simulate, analyze, and solve problems that involve fluid flows. While wind tunnel experiments can also be utilized in the design process, they are expensive and time consuming. CFD provides a less resource exhaustive approach. Due to the complexity of the phenomena experienced in hypersonic flows, they are difficult to accurately simulate and in recent years bridging this gap has been a high priority. SU2-NEMO is an open-source CFD code developed for the accurate modeling of high Mach number flows. In order to validate developments with SU2-NEMO, test cases need to be developed. One approach in the development of test cases is creating a simulation based on an experiment and comparing the results. The Isotope Reentry Vehicle (IRV) test case is based on experiments done to study ablation during atmospheric reentry. The governing equations for this test case are the Navier-Stokes equations for flows in thermochemical nonequilibrium. The aim of this study is to find good agreement between the experimental and computational results.

Abigail Vallance

1) Psychology 2) Sociology at Aquinas College

Mentored by Jonathan G. Tullis, PhD, MEd
(Educational Psychology)



Demographic Information Improves Perspective-Taking

Understanding the level of others' knowledge is essential, especially in our growing educational, professional, and relational society. People naturally put themselves in another person's shoes when accounting for differences in perception viewpoints. People who were found to have either high cognitive flexibility or high intelligence levels employ the feedback mechanisms that allow them to change their perception based on their environment (Colzato et al., 2006; Gunduz, 2013; Zmigrod et al., 2019, as cited in Morgan et al., 2022; Furr et al., 2012, as cited in Morgan et al., 2022; Varanda & Fernandes, 2017, as cited in Morgan et al., 2022). People make an initial judgment and then adjust this as needed, similar to adjusting an anchor in the water (Tversky & Kahneman, 1974, as cited in Nickerson, 1999). When utilizing the background knowledge of the message sender and receiver, people are better equipped to assure message validity (Fussell and Krauss, 1991; Fussell and Krauss, 1989a, 1989b, as cited in Nickerson, 1999). This research study aimed to identify how, when given demographic information, participants will perceive others' level of knowledge. The social construct of age, race, and gender have influenced our perception of others but to what extent? The data from this research showed a trend that demographic information could improve predictions of others' knowledge. Demographic information numerically improved the accuracy of predictions, but not significantly. This knowledge could help further predict the level of knowledge people hold, based solely on their demographic information.

Treasure Wells

Psychology at Louisiana State University

Mentored by David Sbarra, PhD (Psychology)

Systematic Mapping of Demographic Changes in Social Isolation: A Preregistered Systematic Mapping of the Empirical Literature

In 2023, the U.S. Surgeon General issued a major Advisory report on the health risks associated with social disconnection and growing concerns regarding the prevalence of loneliness and social isolation. Although the report describes an “epidemic of social disconnection,” the literature addressing this question is unclear, and this is especially true for the question of whether social isolation is increasing over time. While some studies have focused on changes in loneliness, there is limited research addressing trends in social isolation specifically, and the existing research included mixed reviews and conflicting conclusions. The goal of this project is to establish a protocol for systematic mapping that can be preregistered and guide a formal literature review seeking a comprehensive evaluation of the breadth, depth, and extent of longitudinal research on social isolation encompassing its prevalence, progression, and risk factors. To set up the study, a scoping search was conducted using PsycInfo and Google Scholar. We began identifying related papers on social isolation to catalog keywords and phrases to narrow down search strings to pull more related research. We are drafting a research plan, identifying search terms, independent/dependent variables, and identifying inclusion/exclusion criteria. In documenting this research plan, we are preparing transparent guidelines for a literature review on social isolation. By doing so, we seek to address the knowledge gap in understanding social isolation trends over time, exploring how isolation manifests across various socio-cultural landscapes and identifying potentially vulnerable groups.

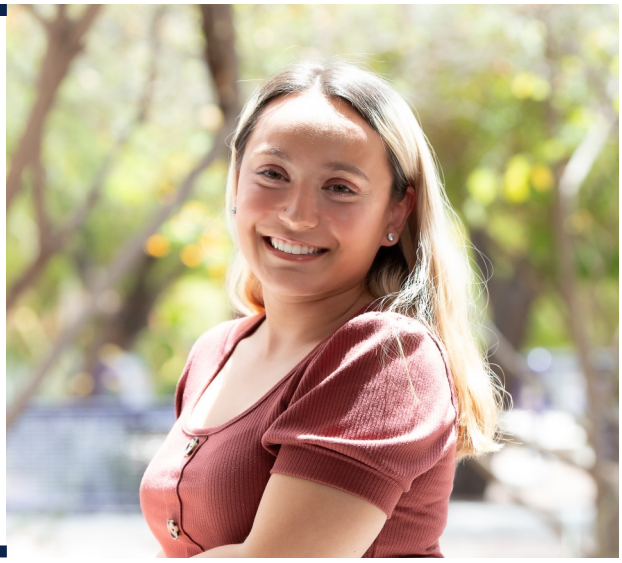
ASEMS Scholar Training Academy for Research in STEM (STARS)

PI: Jennifer Batchelder, PhD
Co-PI: Rebecca Gomez, PhD
Co-PI: Nura Dualeh, MA
Coordinator: Leah Callovini, MS
Instructor: Leah Callovini, MS
Graduate Teaching Assistants: Melinda Willet Struyk, MA, ABD and Lidia Azurdia Sierra, MPH
Sponsors: Gordon and Betty Moore Foundation, Arizona Science, Engineering, and Math Scholars (ASEMS) Program, University of Arizona Graduate College

Alexis April Aguilar

Psychology at University of Arizona

Mentored by Michael Grandner, PhD, MTR, CBSM, FAASM and Dora Valencia (Psychiatry)



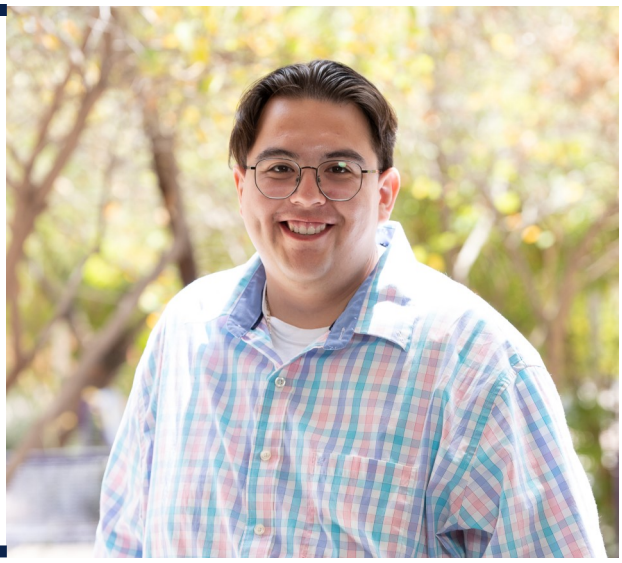
Familismo (Family Sleep Health Study)

Prior literature has shown that socio-ecological factors influence sleep. However, there is a lack of research on the intersection of lifestyle factors and socio-ecological factors and how they affect sleep health. Accordingly, the parent pilot study has 3 main goals: (1) to investigate family-level sleep and acculturative factors to develop future, culturally, and socially tailored interventions to improve overall sleep health and well-being in families living at the Mexican border, (2) advance the science of translational cardiometabolic health disparities research by developing strategies that can be explored mechanistically in future research, (3) determine feasibility and acceptability of a 3-session novel family-oriented intervention to improve sleep health and nutritional outcomes. This sub-analysis aims to assess how acculturation within families of Mexican descent, residing at the US-Mexico border, is associated with multiple measures of sleep health. We theorize that participants and families with higher Mexican acculturation scores will have higher sleep efficiency mean scores. Presently, data have been provided by 13 families residing in the border city of Nogales, AZ. Four families were composed of three generations, including a parent figure, an adolescent between the ages of 13-17, and an elder adult aged ≥ 65, and 9 families were composed of two generations, including a parent figure and an adolescent between the ages of 13-17. All participants have completed the Acculturation Rating Scale for Mexican Americans (ARSMA-II) at three different time points in the study and completed daily online sleep diaries for four weeks; the results will be finalized soon.

Juan Antonio Ayon Vazquez

1) Neuroscience & Cognitive Science 2) Psychological Science at University of Arizona

Mentored by Ulises Ricoy, PhD, John Moore, and Megan Dwyer (Neuroscience)



Gromphadorhina Portentosa As A Model for Addiction Research

Addiction researchers have long been using Vertebrate models, while invertebrates have just begun to spark interest among researchers. Embracing invertebrate models, including *Gramphadorhina Portentosa*, in neuroscience dramatically expands the scope and scale of research possibilities. The *Gramphadorhina Portentosa* Model has been used in Toxicology research, and their rigidness allows it to be a great tool in neuroscience for its cheap upkeep and observable social behaviors while also enabling a significant increase in data collection across diverse experimental designs. The democratization of research fosters a global community of neuroscientists, amplifying voices from regions that may have been underrepresented due to funding and infrastructure constraints. This current project involves using *gramphadorhina portentosa* as a model for addiction research, using vapor and injection exposure of nicotine to understand the effects it can have on the Ventral Nerve Cord excitability in the roaches, but also seeing if any observable behavioral changes come up after the exposure period. After the exposure period, the “Withdrawal Period” begins to see changes in irritability in the cockroaches, changes in food consumption, and grooming behavior to align with the DSM’s classification for Nicotine Addiction. Ultimately, a more inclusive community in neuroscience enhances scientific progress and promotes social justice and equity in the field, aligning with the broader goals of advancing human well-being and understanding the complexities of the brain across diverse contexts.

Tristan Alonzo Britt

Systems Engineering at University of Arizona

Mentored by Bryan Carter, PhD, Pulat Uralov, and Egan Putman (Africana Studies)

THE UNIVERSITY OF ARIZONA

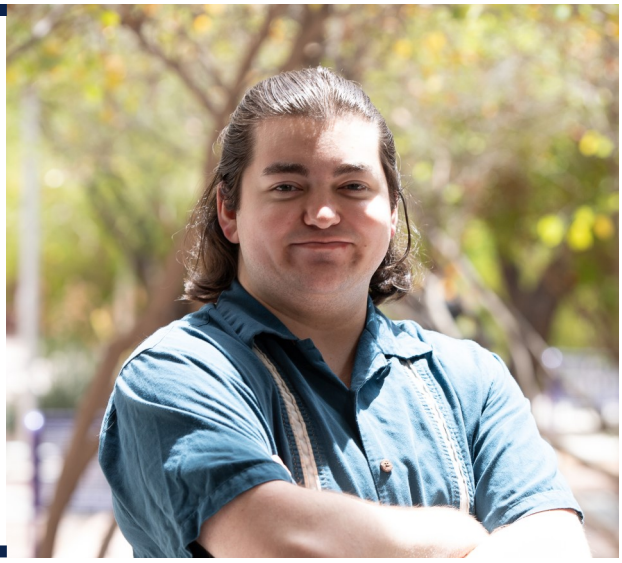
AI in Healthcare: Robotic Secure Assistant

As artificial intelligence continues to grow in capability, healthcare industries have found more of a need to integrate artificial intelligence into their day-to-day use. This research will be conducted via a thorough analysis of how an artificial intelligence could be used to assist in bedside care. By analyzing the design and development of artificial intelligence within a personal assistant robot, we can understand and design a safe and secure way to communicate with artificial intelligence. The proposed application will utilize voice biometrics to authenticate and secure user information, so a user can communicate with the system without compromising user data. The effectiveness of the system will be evaluated through testing and data analysis. This would include testing for the effectiveness of the robot to collect data and the level of data security it retains in the process. The robot would have to remember and recall previous users while also identifying new users. The hope is that when the robot is spoken to, it will identify the voice and remember the voice so that a person with a different voice cannot access the data within the latter conversation. If the system works, this research could aim to assist nurses and reduce the stress and strain on personal healthcare units by reducing the menial tasks normally performed by a bedside care unit.

Mateo Espinoza

Neuroscience & Cognitive Science at
University of Arizona

Mentored by Matthew Grilli, PhD and Daniel Cohen (Psychology)



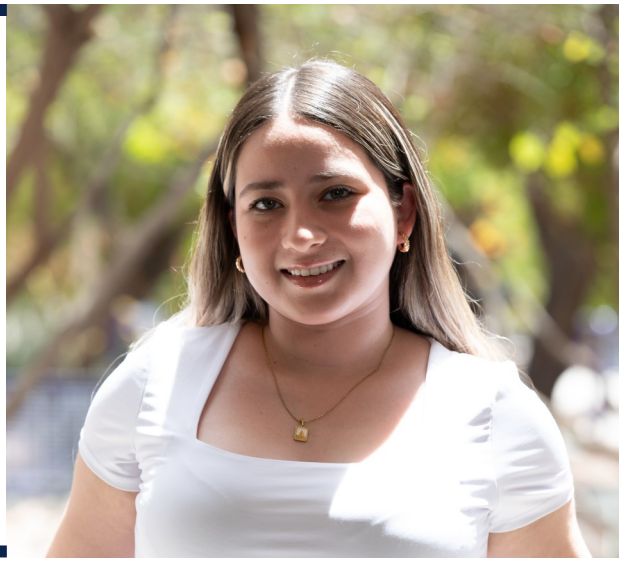
Age-group Differences between Discourse Marker use in Narrative Speech

Discourse markers (short transition phrases such as “I mean,” “you know,” and “like”) are useful for coordinating the interaction structure between the speaker and the listener. However, an individual’s need for using discourse markers may indicate that they are experiencing cognitive challenges while speaking. We investigated how discourse markers differ between young and older adults using two distinct narrative speech tasks, one probing episodic memory (“Recall a recent memory”) and the other probing semantic knowledge (“What does aging well mean for you”?). We hypothesized that young adults would use more discourse markers than older adults in the semantic knowledge task and older adults would use more discourse markers than young adults in the episodic memory task, consistent with evidence that young and older adults have distinct strengths in episodic and semantic knowledge retrieval, respectively. Using data from the “Aging Well” study, we conducted a 2x2 ANOVA with age group (Young vs. Older) and task as independent variables and discourse markers as the dependent variable. We found that older adults used fewer discourse markers than young adults. We also found that young adults used fewer discourse markers in the episodic memory task than in the semantic knowledge task. Older adults, in contrast, showed no differences in discourse marker usage between the two tasks. These results suggest that discourse markers may reflect cognitive challenges while speaking among young adults. However, discourse markers may not be as suggestive of cognitive effort among typically aging older adults.

Ana Fernandez

Medicine at University of Arizona

Mentored by Lourdes Castañón, MD, FACS (Medicine)



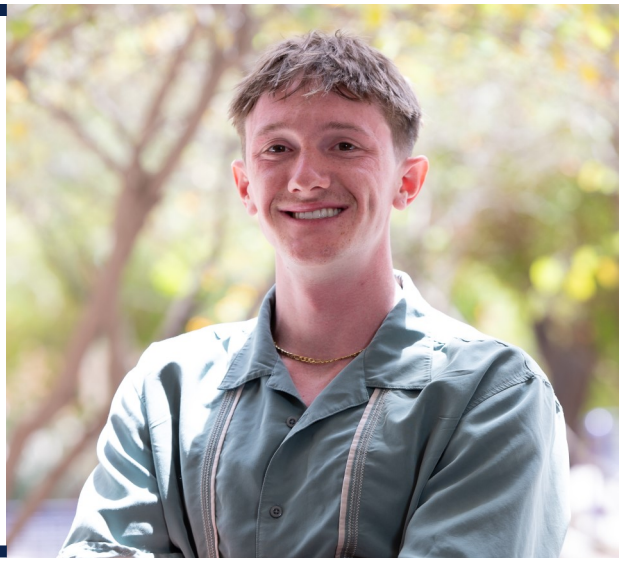
Illuminating the Prevalence of Pseudomonas aeruginosa in Chronic vs. Acute Wounds Using UV Light Diagnosis

The incidence of *Pseudomonas aeruginosa* in wounds poses significant challenges in clinical settings, particularly in distinguishing between chronic wounds and acute burns. This study investigates whether *Pseudomonas aeruginosa* is more prevalent in chronic wounds compared to acute wounds and evaluates the sensitivity of UV light in diagnosing this bacterium. We hypothesize that *Pseudomonas aeruginosa* is more commonly found in chronic wounds and that UV light is an effective diagnostic tool. This prospective study will be conducted at a single institution, involving patients from burn and complex wound clinics. UV black light will be used in a darkened room to detect the presence of Pseudomonas aeruginosa, indicated by green fluorescence. Data on patient demographics, comorbidities, wound type, and wound age will be collected. Photographs of wounds will be analyzed to document the progress and effectiveness of UV light in diagnosis. The study is in the data collection phase, where patient information and wound photographs are being gathered. The collected data will be analyzed to compare the prevalence of *Pseudomonas aeruginosa* in chronic versus acute wounds and to assess the sensitivity of UV light diagnosis. Results will be tabulated to show correlations between the presence of bacteria and variables such as wound type, chronicity, and patient demographics. We anticipate that chronic wounds will show a higher prevalence of *Pseudomonas*. The study aims to confirm the efficacy of UV light as a non-invasive diagnostic tool, potentially influencing future clinical practices for the early detection and treatment of *Pseudomonas* infections in various wound types.

Jack Flanigan

Hydrology at University of Arizona

Mentored by Eleonora Demaria, PhD, Martha Whitaker, PhD, and Nathan Strom (Hydrology and Water Resources)



Recharge Feasibility of Tucson Stormwater Infrastructure

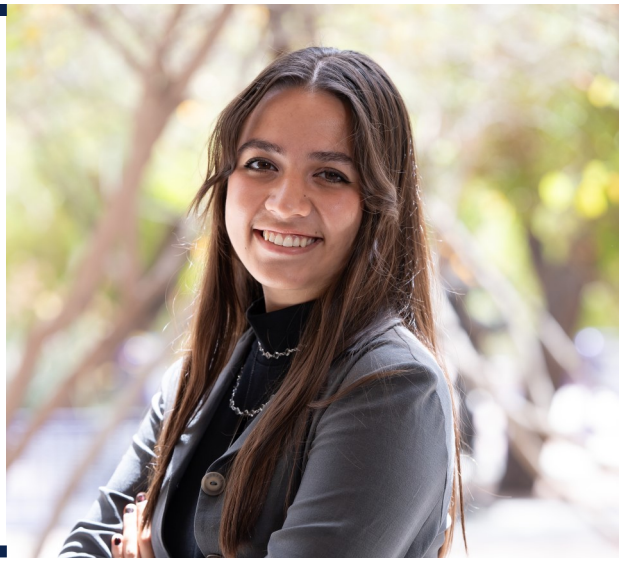
The Pima County Regional Flood Control District (PCRFCD) manages stormwater detention basins that attenuate flooding in several developed watersheds . This includes the Rita Ranch Detention Basin, located 12 miles southeast of downtown Tucson, Arizona. While observational evidence indicates this basin receives enough stormwater to accommodate a Sonoran Desert mesoriparian ecosystem, a lack of sensors in the basin means that the inflow and outflow are currently unknown. Our objective is to determine if this basin can contribute to aquifer recharge. We used HYDRUS-1D to model infiltration and assess the feasibility of the basin to contribute to aquifer recharge. The model uses a water balance approach and requires an input of soil characteristics: jar tests and single-ring infiltrometer measurements were conducted to obtain grain-size distribution and saturated hydraulic conductivity, respectively, and additional soil data were obtained from a cross-section developed by Tucson Water. We also input daily meteorological data from 2011 to 2023, as well as velvet mesquite root water uptake parameters. Preliminary simulations suggest that after meeting plant water needs, excess infiltrated water exits the soil column bottom, indicating that local aquifer recharge is possible. In semi-arid environments like Tucson, stormwater collection and retention are crucial for sustainable water management, as these basins can help replenish over-allocated water resources, support local ecosystems, and mitigate flood risks.

Keywords: Aquifer recharge, detention basin, green infrastructure, groundwater, HYDRUS-1D, Pima County, stormwater, stormwater infrastructure, semi-arid desert environment, Tucson.

Natalia Grazda-Valdez

Veterinary Science at University of Arizona

Mentored by Liliana Salvador, PhD and Assel Akhmetova, PhD (Animal and Comparative Biomedical Sciences)



Understanding the Role of Wild Pigs in Mycobacterium bovis Transmission in Multi-host Systems: A Systematic Review

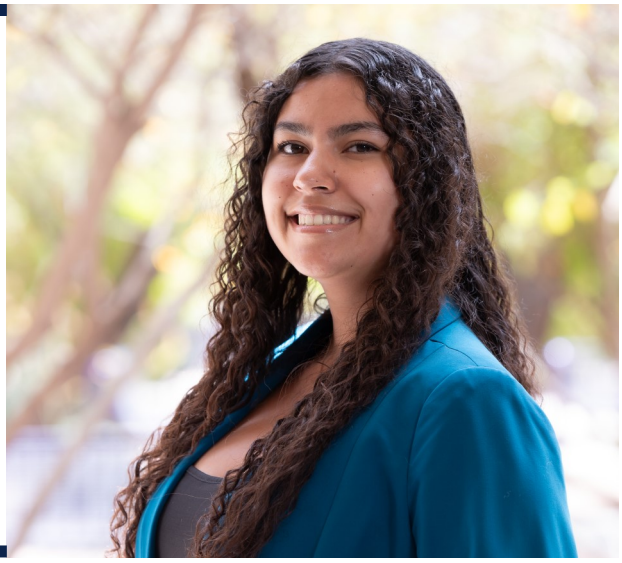
Mycobacterium bovis is the main cause of animal tuberculosis in livestock and wildlife, which can also infect humans causing zoonotic tuberculosis. The issue surrounding this mycobacterium lies with spread and control of animal tuberculosis at the wildlife, livestock, and human interface, presenting a global economic and public health challenge. On the island of Moloka'i, Hawaii, a series of animal tuberculosis outbreaks occurred from 2021-2022, involving cattle, axis deer, and wild pigs. The outbreak implicated the wild pig population living there as a maintenance host for *Mycobacterium bovis*, emphasizing a unique regional situation in which varying conditions result in a species maintaining a pathogen within its population. Maintenance hosts are species with the ability to sustain the presence of a pathogen in an area regardless of whether there are other species around who can disseminate it as well. A thorough understanding of the factors that promote maintenance host status is necessary to better improve disease control. We intend to conduct a systematic review, following the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines and utilizing the PECO search method for determining keywords. We aim to define the epidemiological, ecological, and behavioral factors that promote wild pigs (*Sus scrofa*) as maintenance hosts for *Mycobacterium bovis* transmission. Understanding and defining these factors will allow us to address not only the transmission of *M. bovis* in wild pigs on Moloka'i, but in other wild pig populations, informing guidelines applicable to different regions for efficient prevention and control.

Keywords: wild pig; Sus scrofa; animal tuberculosis; Mycobacterium bovis; transmission factors; maintenance host

Dayzee Guerrero

Veterinary Science at University of Arizona

Mentored by Evan MacLean, PhD, Stephanie Hargrave, and Lorelei Switzer (Veterinary Medicine)



Canine Visual Discrimination Tasks: Touchscreen Variations

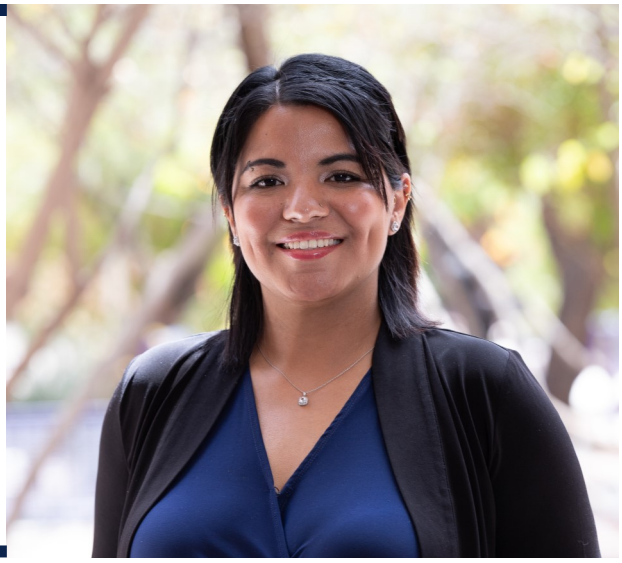
Decision making is often studied in human and non-human species, including canines, using visual discrimination tasks on a touchscreen. In this study, we are testing a sample of dogs in a visual discrimination task, using a custom mobile touchscreen designed for dogs. In Study 1, 17 dogs were tested on their discrimination ability between two images. The goal is a learning criterion of 75% mean accuracy over two consecutive testing sessions. Although a set of dogs have met the criteria (N=8), they required an ample number of sessions to do so (N>10), and the remaining dogs (N=9) failed to meet the criteria within 20 sessions. We hypothesized that slow learning might have been due to challenges associated with viewing stimuli at a close distance and a lack of inhibitory control. To allow for greater distance and a reset during each session, we are integrating a physical start button that will be positioned approximately 2m away from the touchscreen in Study 2. We are currently training dogs to trigger the start button and will ultimately compare visual discrimination performance of dogs between both studies. We hypothesize that if subjects can view visual stimuli at a greater distance, their discrimination performance and learning rates will improve. This research will inform fundamental questions about dog vision and allow for more efficient approaches to canine cognitive experiments with touchscreens.

Keywords: Touchscreen, Visual discrimination, canine, dog, Inhibitory control, Perception, cognition

Azucena Abiah Hughes

1) Biology 2) Biomedical Engineering at University of Arizona

Mentored by Suzann Duan, PhD (Medicine)



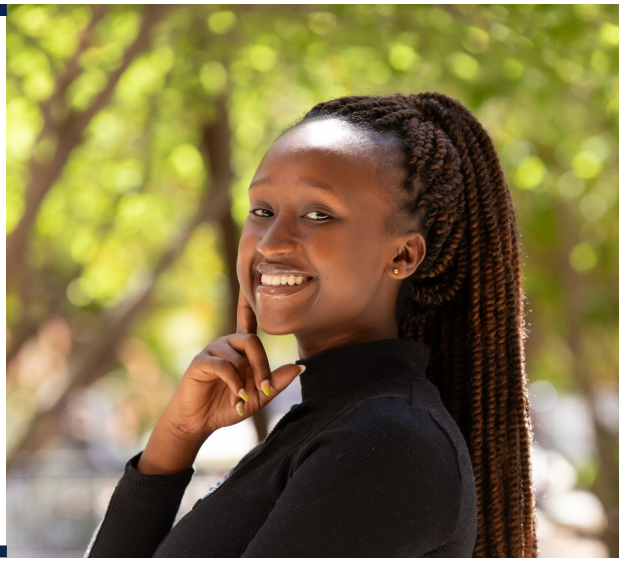
Investigating ZBP-89-mediated Suppression of Gastrin Hormone Expression using an Inducible Cre Mouse Model

Heightened awareness and surveillance have led to an increase in the diagnoses of neuroendocrine tumors (NETs). Gastrinomas are gastrin-secreting NETs that develop in the pancreas, proximal small intestine, and gastric antrum; their etiology remains poorly understood. Prior studies identified Zfp148, encoding the zinc finger binding protein ZBP-89, as a negative transcriptional regulator of gastrin gene expression. However, the potential role of ZBP-89 in gastrinoma development has not been explored. Here, we investigated the hypothesis that loss of ZBP-89 in gastrin-expressing cells (G cells) derepresses gastrin hormone expression and stimulates G cell hyperplasia. We generated a genetic mouse model whereby Zfp148/ZBP-89 was deleted in G cells by expressing a tamoxifen-responsive Cre recombinase (Cre-ERT2) under the control of the gastrin promoter (Gastrin Cre-ERT2; Zfp148FL/FL). An additional cohort of mice was bred onto the APCFL/+ background to accelerate hyperplasia. Cre activity was induced by injecting mice with tamoxifen (TAM), and mice were necropsied after 8–12 months of treatment. Immunohistochemical staining (IHC) was performed to evaluate G cell hyperplasia, and gastrin mRNA and peptide levels will be measured by quantitative polymerase chain reaction (qPCR) and enzyme immunoassay (EIA), respectively. IHC staining confirmed the presence of gastrin-expressing cells localized to the crypts of the gastric antrum. We quantified G cell numbers in Gastrin Cre-ERT2; Zfp148FL/FL mice, and the designated control group (wild-type mice littermates). Gastrin peptide and mRNA levels will be measured in mice's gastric tissues and serum to confirm the IHC findings. Currently, data are still being collected, and the results are ongoing.

Peniella Irakoze

Microbiology at University of Arizona

Mentored by Travis Wheeler, PhD, David Baltrus, PhD, and Clément Goubert, PhD (Pharmacy)



Evaluating the Performance of the Pipeline GraffiTE at detecting Prokaryotic Mobile Elements Insertion Polymorphisms

Insertion sequences (ISs) are a type of prokaryotic mobile elements, able to multiply and insert at new loci within bacterial genomes. ISs' movements cause genetic variation hereinafter referred to as insertion polymorphism. Moreover, ISs can have regulatory roles by activating, repressing or removing genetic material from the genome. To date, thousands of distinct IS families have been documented. Many existing bioinformatic tools are limited to identifying ISs within one genome, but do not allow an automatic comparison of IS presence/absence across genomes. To fill this gap, we are considering a new tool called "GraffiTE" that maps insertion polymorphisms of mobile elements in eukaryotes, but its performance is yet to be evaluated in prokaryotes. Indeed, this program expected to be able to compare thousands of IS elements across multiple strains in only a few minutes. To test GraffiTE, three bacterial strains Pla107, YM7902, NM002 of *Pseudomonas pathovar*- Lachrymans -- known to infect cucumbers -- were chosen, as they harbor ~100 copies of the IS5 family, many being differentially present or absent between the strains, and GraffiTE's results were compared to a manually curated dataset. The program identified polymorphic loci with relatively low sensitivity (41%) but high precision (87%). Furthermore, when a locus was predicted polymorphic, GraffiTE predicted the IS presence or absence pattern across genomes with both high sensitivity and precision (>90%). The lack of sensitivity to detect IS polymorphisms, which may be caused by the high level of variation between bacterial genomes, will be thus the focus of further developments.

Riley Jeong

Public Health at University of Arizona

Mentored by Melissa A. Barnett, PhD (Human Development and Family Science)

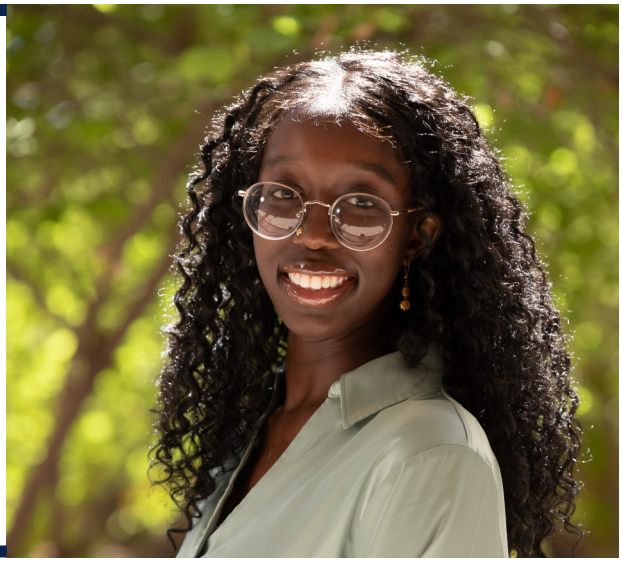
Grandparent Well-Being: Financial Stressors and Community Characteristics

With increases in life expectancy and working families, grandparents are becoming more involved in their grandchildren's lives, often taking on considerable caretaker responsibilities in the United States. Due to the limited research on non-custodial but highly involved grandparents, this study aims to examine individual financial stressors and zip code-based community characteristics in correlation to non-primary caregiving grandparent well-being. It is hypothesized that non-primary caretaking grandparents who experience higher levels of individual perceived financial stress or reside in communities with higher percentages of child poverty, childcare cost burden, and severe housing cost burden will report poorer well-being. Data were collected via an anonymous online survey from 474 grandmothers, providing at least 20 hours of weekly care to a grandchild aged two to six. Financial strain was assessed on 5-point scale (α = .87, M = 2.6, SD = 1.08), and well-being with the Satisfaction with Life Scale (α = .72, M = 4.98, SD = 1.35). Community characteristic data (child care cost burden, housing cost burden, and child in poverty) were matched by zip code using values from County Health Rankings. Bivariate correlation and multiple regression analyses showed a negative correlation between individual financial stress and life satisfaction and no correlation between all community characteristic variables and life satisfaction. These findings suggest that research efforts should aim to better understand the specific stressors and needs of grandparents, when looking at grandparents in families holistically and older populations.

Sara M. Kafi

Biology at University of Arizona

Mentored by Mary Alt, PhD, CCC-SLP and Sarah Cretcherm, MS, CCC-SLP (Speech, Language & Hearing Sciences)



Using Design Thinking to Address Communication Between Non-Speaking Children and Pediatric Dentists

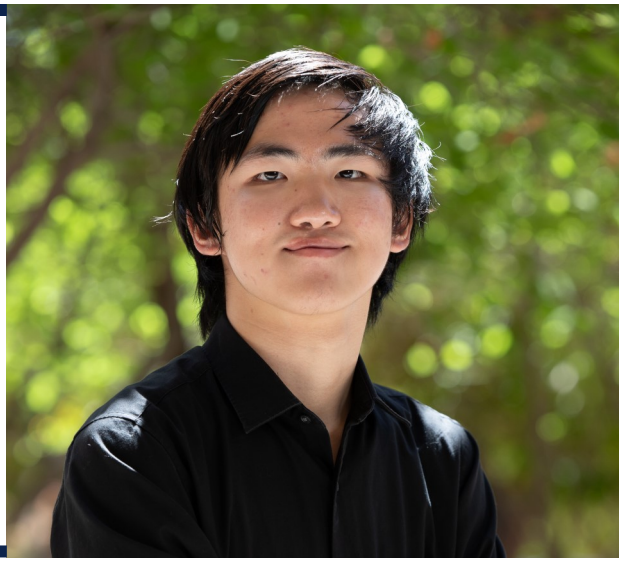
Communication encompasses various forms of expression, including verbal, non-verbal, written, and visual. It is essential for building understanding and fostering collaboration in personal and professional settings. However, communication can be challenging for non-speaking individuals, especially children, leading to frustration and isolation. This research explores the potential use of Augmentative and Alternative Communication (AAC) in dental offices to improve communication between non-speaking children and healthcare providers. While AAC has succeeded in speech therapy, its effectiveness in medical settings, particularly dentistry, remains understudied. This study investigates the potential of AAC in encouraging better communication and relationships between non-speaking pediatric patients and dentists within dental offices. Through interviews with pediatric dentists and guardians of non-speaking children, and the use of The Design Thinking Process, this research seeks to gather feedback on the practicality and effectiveness of AAC in dental practices. The structure and purpose of Design Thinking profoundly help the study in a way where we can emphasize with non-speaking children and try to devise alternative ways of communication that can potentially improve healthcare experiences and outcomes for an underserved demographic.

Keywords: Augmentative & Alternative Communication (AAC), Communication, Dentists, Non-Speaking, Speech Therapy, The Design Thinking Process

En-Chi Lee

1) Geosciences 2) Planetary Geoscience at University of Arizona

Mentored by Christopher Harig, PhD (Geosciences)



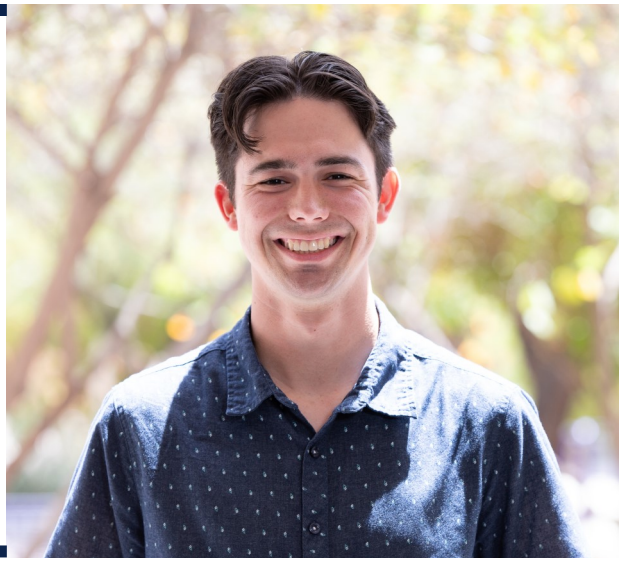
Estimating Basin-Scale Sea Level Budgets with Satellite Gravity

The global mean ocean mass change in the 21st century is relatively well understood. However, there are fewer estimates for sea level budgets at the basin and sub-basin scales. In these regional studies, ocean mass estimates derived from GRACE satellite data and steric-corrected altimetry often show differences within individual ocean basins, particularly in the Atlantic and Indian Oceans. The underlying cause of these discrepancies remains unclear. Our study demonstrates that using Slepian functions to spatially and spectrally localise GRACE data yields reliable estimates of ocean mass changes at the basin scale. With synthetic experiments, we show that Slepian functions are effective and require a much narrower buffer kernel (approximately 1°) than most other methods used in previous attempts, therefore retaining more ocean signals. With this approach, we estimate that the global mean ocean mass between 2003 and 2022 is increasing at a rate equivalent to 2.07 ± 0.05 mm per year of sea level rise, consistent with previous studies. Regionally, the South Atlantic Ocean has the largest mass increase rate of 2.95 ± 0.12 mm per year, while the North Pacific Ocean has the smallest rate (1.20 ± 0.09 mm per year). Our results suggest that the Slepian functions can be used to provide a more accurate estimate of the ocean mass trend at the basin scale, and the sea level change varies significantly across regions.

Chalen A. Lozano

A-Center (Pre-Engineering) at University of Arizona

Mentored by Vitaliy Yurkiv, PhD (Aerospace & Mechanical Engineering)



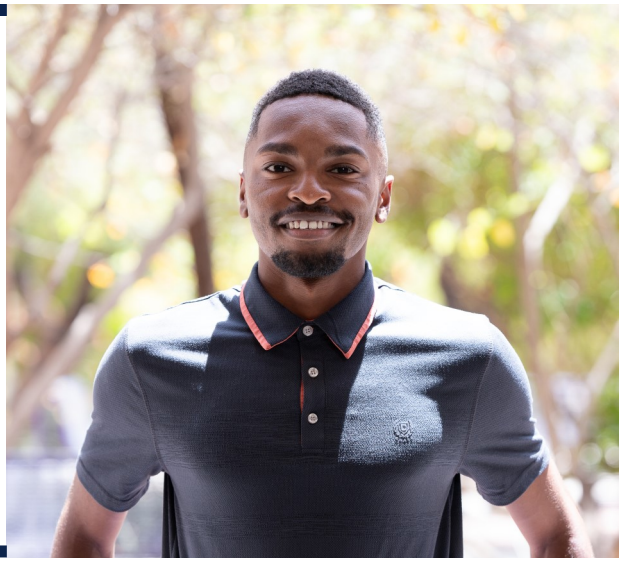
Enhancing Electric Vehicle Battery Safety Through Thermal Behavior Analysis

Annually, millions of lithium-ion batteries (LIBs) are produced for electric vehicles (EVs), a crucial component susceptible to severe faults such as overheating leading to fires or explosions. Thus, the goal of our research is to enhance the safety and efficiency of commercial LIBs by identifying and understanding their thermal behavior. We studied the thermal behavior of two types of Tesla batteries: 2170 and 4680, under varied electrical stresses, using constant and variable C-rates. Our methodology simulated real driving conditions through Fourier series cycling as well as the FTP75 driving cycle to observe the effect of rapid acceleration on battery durability. Tests were conducted from room temperature to a controlled environment of 10.0 degrees Celsius, simulating different scenarios, and results were taken as a measure of battery performance under varied conditions. Higher C-rates considerably increase battery temperatures, this once more confirms the importance of climate-controlled testing to avoid thermal runaway and extend LIBs life. It is indeed very interesting that an application of the Fourier series to the battery cycling data revealed the harmonic responses of these rapid charge and discharge phases, which can lead to swift rises in temperature and thermal shock. We suggest that, whereas batteries may work reasonably well under conditions of low stress, their lifetime and performance are very poor under high-stress conditions induced by controlled environments because of thermal shocks. Such a study paves the way for future investigations concerning the thermal management of EV batteries, which could affect vehicle design and safety standards.

Collins Maiyo

Biology: Biomedical Sciences emphasis at University of Arizona

Mentored by Stefano Guerra, MD, PhD, MPH and Alane Blythe C Dy (Medicine)



Pulmonary restriction is a risk factor for mortality by pneumonia

Spirometric restriction is an abnormal spirometric pattern typically defined as having a reduced forced vital capacity (FVC) with a preserved forced expiratory volume in 1 second (FEV1)/FVC ratio. Previous work from our group has shown spirometric restriction to be associated with morbidity and mortality. In this study, we hypothesize that having spirometric restriction is associated with an increased likelihood of mortality specifically from pneumonia. We used data from the Tucson Epidemiological Study of Airway Obstructive Disease (TESAOD), which was started in 1972 and has questionnaire and lung function data across multiple surveys, as well as mortality data up to January 2021. All-cause mortality was analyzed using Cox proportional hazards regression and cause-specific mortality was analyzed using competing risks analyses. Kaplan Meier graphs were also created to visualize the survival curves for both the mortality of pneumonia and all-cause mortality. All analyses were adjusted for age, sex, body mass index and smoking (pack-years). Our findings revealed a significant association, with individuals exhibiting a restrictive lung pattern showing a hazard ratio of 2.12 for cause specific mortality from pneumonia ($p = 0.030$). The corresponding hazard ratio for all-cause mortality was 1.56 ($p<0.001$). These results provide compelling evidence of a substantial link between spirometric restrictive lung patterns and mortality by pneumonia, with individuals with spirometric restriction being more than twice as likely to die of pneumonia as individuals with no spirometric restriction. This finding shows the importance of lung function testing and may help inform targeted treatment strategies for improved patient outcomes.

Ashley McKinley

Sustainable Plant Systems at University of Arizona

Mentored by Joseph Blankinship, PhD (Environmental Science)

Comparing Effects of Organic and Conventional Farming Practices on Soil Health in Desert Croplands

The future of food production in the US depends on deserts that produce over 90% of fresh leafy vegetables between November and March. In desert croplands, food production especially depends on soil health, which is currently being degraded by intensive agricultural practices. Soil health comprises physical, chemical, and biological processes that enable plant growth and other ecosystem services such as climate mitigation through carbon sequestration. Organic-certified practices have been proposed to achieve healthier soils in desert croplands, but there is little data to confirm this approach. Therefore, this study asks: Do organic farming practices produce healthier soils than conventional practices? I hypothesized that in arid croplands the application of organic amendments causes soils with Organic practices to be healthier than soils with conventional practices. Qualitative data were collected through farmer interviews to discern key differences between Organic and conventional farming practices. Quantitative data were collected in Organic and conventional vegetable fields in Yuma, Arizona to quantify their effects on physical, chemical, and biological components of soil health. Farmers predominantly used biofertilizers and bio-controls in organic fields, whereas conventional fields tended to have synthetic chemicals. However, farm management practices and field inputs varied greatly among farmers. Organic soils showed higher total microbial biomass but also higher levels of harmful salts and a lower capacity to retain water. Unexpectedly, Organic practices did not affect soil pH, soil physical stability, or plant symbioses with arbuscular mycorrhizal fungi. Therefore, Organic practices alone do not seem to produce healthier soils in Arizona's desert croplands.

Katie Murray

Biology: Biomedical Sciences emphasis at University of Arizona

Mentored by Adam Buntzman, PhD and Sydney Robbins (BIO5)

The future role of AMPs in the fight against Valley fever

Valley fever is a fungal disease caused by inhalation of fungal spores from *Coccidioides immitis* or *Coccidioides posadasii*. The highest rates of infection for Valley fever are here in Arizona. Despite its prevalence, many clinicians have difficulty diagnosing and treating Valley fever due to its variability of presentation and its tendency to become clinically latent. Once inhaled, the cocci spore forms a spherule in the lungs and it is unknown if the immune system can biologically clear it in humans. The spherule can remain in the pulmonary region indefinitely or until the spherule ruptures and releases endospores. These endospores can then restart the cocci lifecycle, leading to multiple pulmonary granulomas or dissemination to extra-pulmonary regions including the bones, skin, the central nervous system, and more. Currently available therapeutic options include the azole family of fungistatic pharmaceuticals rather than fungicidal. These medications only inhibit cocci replication and do not address any latent spherules. To combat fungal latency and avoid future reactivations, we will test the use of antimicrobial peptides against *C. posadasii* in vitro and observe any fungicidal capabilities exhibited. Our goal is to implement these findings into a larger-scale project where Chimeric Antigen Receptor Cells are utilized to deliver antimicrobial peptides and biologically clear cocci and prevent potential latent infections from resurfacing.

Keywords: Valley fever, antimicrobial peptides, Coccidioides immitis, Coccidioides posadasii, spherule, endospores, azole

Darwyn A. Stygian

Neuroscience & Cognitive Science at
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Mentored by Jessica Andrews-Hanna, PhD and
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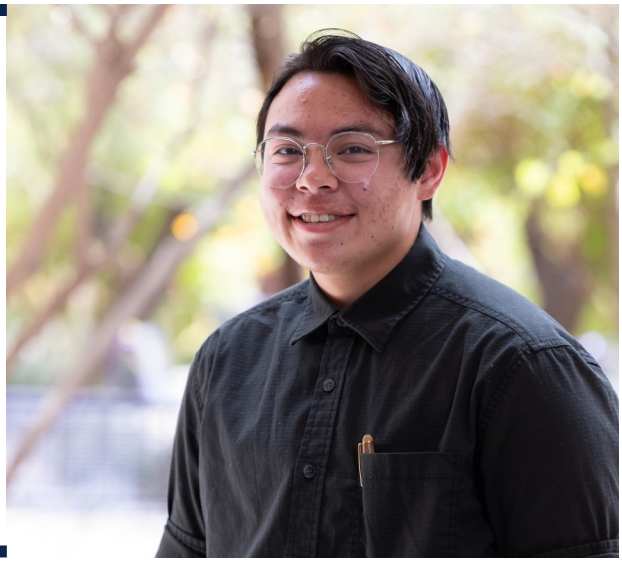


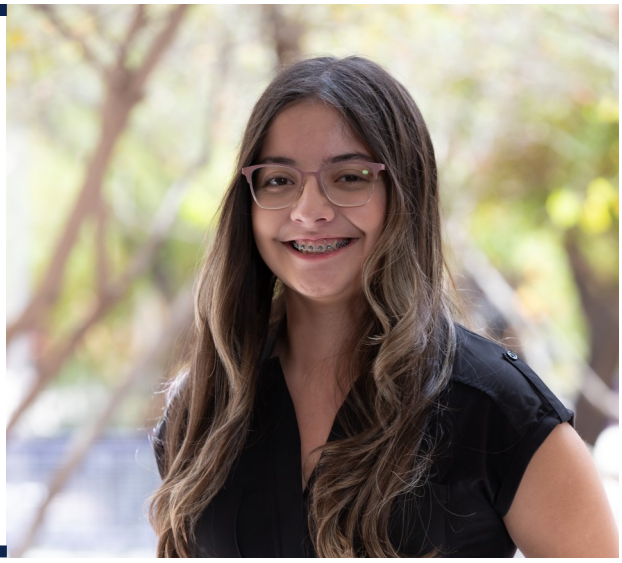
Connections between Abstract Concepts in Idle Thoughts, Creativity, and Curiosity

The process of creativity is intertwined with abstraction and curiosity. Trait curiosity influences one to seek out the unknown and explore the environment, inducing the creative process to take in the newfound elements to create and facilitate further exploration. Creativity uses abstract knowledge and concepts to aggregate elements gathered by curiosity into a framework upon which to build new ideas. Abstract words represent ideas or concepts that don't have sensorimotor correlates and are often explored through creative endeavors. With the interconnected nature of creativity, curiosity, and abstraction, it's unclear if there is any substantial connection between curiosity and abstraction to creativity, respectively. This study is working off the hypothesis that those who use more abstract words when voicing their idle thoughts aloud are more likely to have higher scores on both curiosity and creativity measures. In addition to completing a questionnaire that measured curiosity and a divergent thinking task that measured creativity by way of originality, participants were instructed to voice their idle thoughts aloud for ten minutes. From the transcripts, each word was rated on its abstractness and mean abstract score was compared to scores on the curiosity and creativity measures. This study aimed to determine if there is a correlation between abstract word usage when voicing idle thoughts aloud and scores on a curiosity inventory and an originality task. Analysis of the results revealed no significant correlation between number of abstract words, mean abstract score, creativity scores, and curiosity scores.

Arianna Yasmin Tabanico

Speech, Language, and Hearing Sciences at University of Arizona

Mentored by Genesis D. Arizmendi, PhD and Camila Itzel Castillo (1) Cognitive Science 2) Speech, Language, and Hearing Sciences)



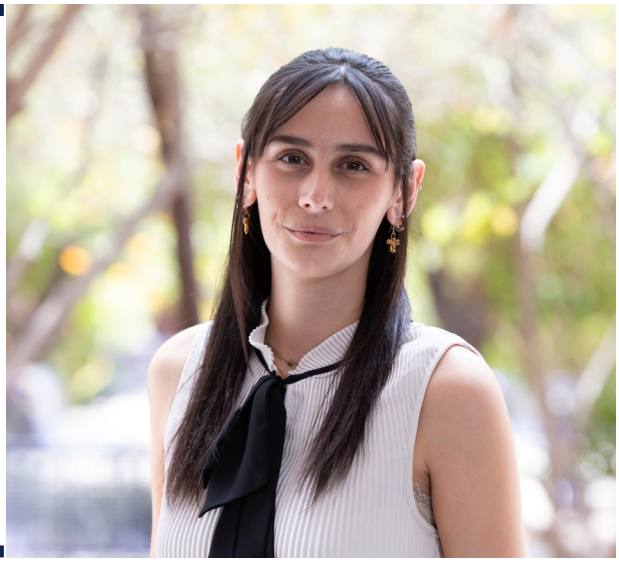
Developing Culturally-Responsive Educational Curriculum for High School Students for Promotion of Careers in Communication Sciences & Disorders

The field of Communication Sciences and Disorders encounters significant challenges in diversity, inclusion and equity, as it is a field that has a limited number of multilingual speech-language pathologists and audiologists who can serve minoritized populations. This highlights the need for diversity within the professionals in the field to ensure equitable service delivery for patients and families. This study focuses on empowering high school students and bringing awareness about careers in the field of speech-language pathology and audiology and how to navigate the barriers that hinder students from pursuit of these careers. To address the disparities within the field, we developed culturally-responsive pedagogies that can be embedded within the high school curriculum to help bridge access to higher education. By applying community insider knowledge, we developed culturally-responsive educational modules to inspire students to pursue a career within the field. The educational topics were informed and guided by discussions and insights shared by minoritized, first-generation students in the Bilingualism And the Brain in Education and Language lab located within Speech, Language and Hearing Sciences at the University of Arizona. The educational modules are focused on common themes that were identified within these discussions, centered on: cultural awareness, higher education, language, and human development. The program will begin fall 2024 with partnering high schools in Southern Tucson. This program has the potential to positively impact minoritized students and their communities, by fostering career and higher education awareness and community building, focused on addressing the needs of the community.

Itzi Valenzuela

Neuroscience & Cognitive Science at
University of Arizona

Mentored by Michael Hammer, PhD, Patrick Ronaldson, PhD, and Collin Krzyzaniak (Neurology)



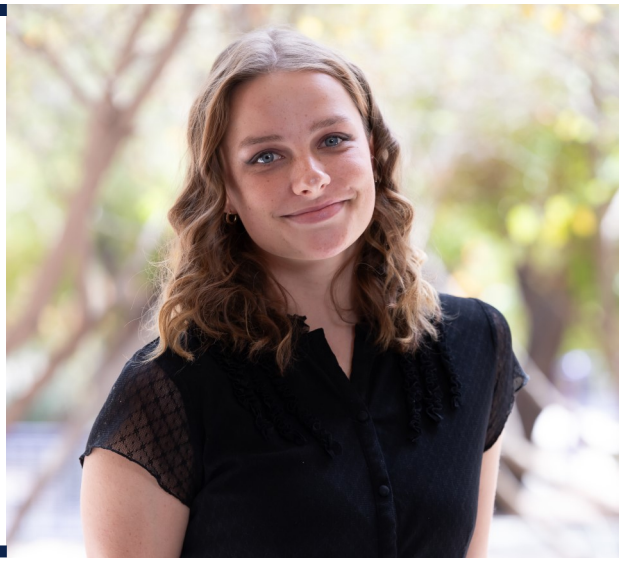
Visualizing Blood-Brain Barrier Dysfunction during Epileptogenesis in a Genetic Scn8a Mouse Model

Gain of function mutations in the Scn8a gene (i.e. N1768D) which encodes the voltage gated sodium channel (NaV1.6) is cause for a rare form of pediatric epilepsy. Although widely understudied, the blood-brain barrier (BBB) plays an important role in understanding the pathophysiology of epilepsy. The BBB is comprised of endothelial cells held together by tight junction (TJ) proteins and ~90% covered by astrocytes responsible for facilitating proper barrier function. Preliminary data shows that BBB dysfunction (BBBD) occurs both before and after seizure onset in the Scn8a D/+ mouse model. A hallmark TJ protein, claudin-5, is significantly downregulated before and after seizure onset, which has been cited to promote BBB permeability. Additionally, reactive astrocytes exacerbate pathological conditions, reducing claudin-5 expression, and worsening seizure outcome. This project visualizes and measures altered expression of claudin-5 and reactive astrocyte marker, GFAP, in pre- and post-seizure Scn8a D/+ male mice. We hypothesize that male Scn8a D/+ mice experience decreased expression of claudin-5 and increased areas of GFAP expression (i.e. reactive astrogliosis) before and after seizure onset as compared to wildtype mice. Paired with Western blot quantification, immunofluorescent staining shows lowered staining intensity of claudin-5 in pre- and post-seizure conditions. Additionally, the area of GFAP expression is seen to increase significantly in pre- and post-seizure conditions. Ultimately, downregulation of claudin-5 and signs of reactive astrogliosis is seen to occur before and after seizure onset in Scn8a D/+ male mice. This project further characterizes the molecular mechanisms of BBBD throughout the generation of Scn8a-related epilepsy.

Nova Vogel

Veterinary Science: Applied Animal Behavior emphasis at University of Arizona

Mentored by Evan MacLean, PhD, Stephanie Hargrave, Noah Stetson, Lorelei Switzer, and Emily Bray, PhD (Veterinary Medicine)



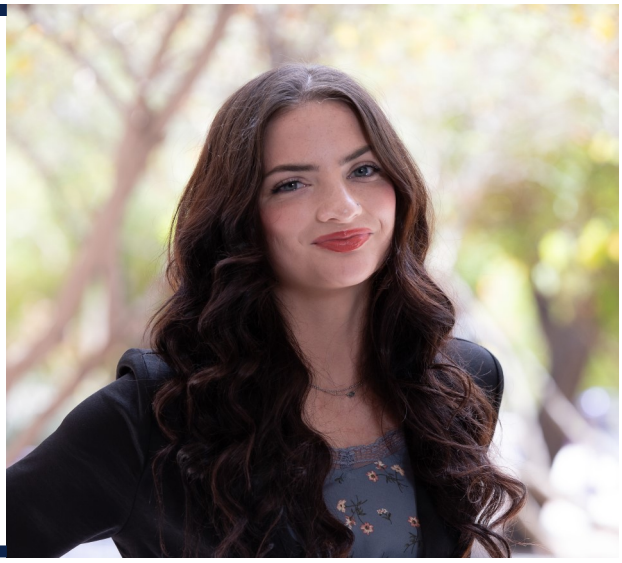
Exploring Qualitative Behavioral Assessment vs Ethograms in Assessing Service Dog Candidate Temperaments: A Pilot Study

Emotions in domesticated dogs are widely discussed in the scientific community, yet, traditional behavior assessment methods, such as ethograms, do not account for these emotions. Qualitative Behavioral Assessment (QBA) provides a supplemental approach to ethograms, focusing on characterizing affective states rather than specific isolated behaviors. Bray et al. (2020) utilized an ethogram to evaluate the behaviors of service dog candidates exposed to novel objects (motion-activated robotic cats) with and without human presence. This pilot study incorporates QBA into assessments of service dog temperaments. Coders in this study used a visual analog scale to rate the emotional states, valence, and arousal of a subset of candidates completing the novel object task. The correlation between QBA Principal Component Analysis (PCA) scores and ethogram PCA scores was strong (Pearson's $r = 0.74$), suggesting that QBA is a valid method of assessing dog reactions to the novel object task. The ethogram PCA summary score was strongly positively correlated with positive valence terms and with valence, and negatively correlated with arousal and negative valence terms. Lastly, this study found that QBA PCA data alone is not a statistically significant predictor of service dog success ($p = 0.22$). Future studies are needed to combine temperament task measurements to explore methods to predict service dog training outcomes, as even in populations of purpose-bred dogs, program completion rates are currently suboptimal, at approximately 50%.

Karlee Marie Wren

Physiology at University of Arizona

Mentored by Brett Colson, PhD, Thomas Bunch, Victoria Lepak, and Morgan Seffrood (Medicine)



Arthrogryposis Mutants in the Slow Skeletal Isoform of Myosin Binding Protein-C: Effects on Actin and Binding

Muscle contractility in skeletal and cardiac is mediated by interactions between actin and myosin that are regulated by sarcomere proteins like myosin binding protein-C (MyBP-C). Within skeletal muscle, the slow skeletal myosin binding protein-C (sMyBP-C) isoform is a regulator of actomyosin interactions. Mutations in sMyBP-C are associated with distal arthrogryposis (DA). DA is a congenital skeletal muscle disorder characterized by joint contractures in distal extremities. Currently, DA is incurable, impacting well-being and functionality. It is unknown how the mutations change sMyBP-C structure or function at the molecular level to result in dysregulated skeletal muscle function. Understanding the molecular interactions that are compromised by the mutations can help in tailoring interventions at the molecular level, to treat the pathological condition and restore muscle contractility. This study focused on mutations P319L and E359K. sMyBP-C fragments were expressed in bacteria, assessed for solubility, and purified. Purified proteins were incubated with actin in binding assays. As phosphorylation modulates sMyBP-C binding, we also tested effects of phosphorylated mutants on actin binding. Results indicated that DA mutants binding to actin, whether phosphorylated or not, showed a change in fluorescence lifetime (FLT) compared to the wild type. Additionally, phosphorylated proteins had a smaller effect on FLT. This suggests the mutations and phosphorylation alter interactions with actin. The mutant sMyBP-C fragments will help elucidate the actin binding activity and regulation by phosphorylation in healthy and pathological states. These sMyBP-C fragments may also be used in testing future drugs aimed at remedying the defects resulting from these specific mutations.