THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE
Undergraduate Research
Opportunities Consortium

2025 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 and is comprised of 7 undergraduate research programs for 2025. Five 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 and the Gordon and Betty Moore Foundation. The objective is to teach participants about the research process and prepare them to apply to graduate school. UROC Scholars engage in faculty-supervised research and participate in a comprehensive graduate school preparation program that includes professional development, graduate admission and funding workshops, presentation skills seminars, and professional research conference experience. We invite you to enjoy the UROC Student Abstract Review and share our students' success.

The UROC 2025 Abstract Journal was
Edited by: UROC Staff & Students
Designed by: Tianna Urrea MacMeans, former UROC Program Coordinator and
Tori Juvera, McNair Administrative Assistant
Photographed by: UCATT and Jasmine Lopez

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 the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. The University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

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, PhD
Graduate Teaching Assistants: Micaela Cruz, MA and Annysa Sapien
Sponsors: Institute of Educational Sciences, U.S. Department of Education, (Award: #R305B20019), University of Arizona Graduate College

Minimizing Health Disparities (MHD)
Program Coordinator: Karla Smith, MPA
Professor of Practice: Caitlin Rosario Kelly, ABD
Sponsor: University of Arizona Graduate College

Ronald E. McNair Postbaccalaureate Achievement Program (McNair)
PI/Program Director: Caitlin Rosario Kelly, ABD
Administrative Assistant: Tori Juvera
Graduate Teaching Assistant: Astrid Liu, MFA
Sponsors: U.S. Department of Education, Federal TRIO Program, Ronald E. McNair Postbaccalaureate Achievement Program (Award: #P217A220105), University of Arizona Graduate College

Summer Research Institute (SRI)
Program Coordinator: Karla Smith, MPA
Instructor: Karla Smith, MPA
Graduate Teaching Assistants: Carolyn Tureaud, ABD
Sponsor: University of Arizona Graduate College

UROC-Prep
Program Coordinator: Karla Smith, MPA
Instructor: Karla Smith, MPA
Graduate Teaching Assistants: Sergio Castro, ABD
Sponsor: University of Arizona Graduate College

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; Collin Krzyzaniak, MS; Athip Thirupathi Raj, Doctoral Candidate
Sponsors: Gordon and Betty Moore Foundation, Arizona Science, Engineering, and Math Scholars (ASEMS) Program, University of Arizona Graduate College

Environmental and Earth Systems Research at Biosphere 2 (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

Access, Wellness, And Relational Determinants of Student Success (AWARDSS) Publishing, policy, practice, Leadership and life-long learning for Underrepresented Students (PLUS) Training Program

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Christina Petrin

Rehabilitation Studies and Services at
University of Arizona

Mentored by Jacy Farkas, PhD
(Family & Community Medicine)

Barriers to Student Success in Higher Education Through the Lens of Students with Disabilities: Assessment and Intervention

The disability community is often overlooked when reviewing higher education students' barriers to access and success. However, students with disabilities contribute to approximately 32% of the student population in higher education. This demographic faces external barriers that students without disabilities may not encounter (outside of other identity-based biases), such as stigma surrounding the type/severity of the disability presented, bias against accommodations, and dismissal of symptoms. Through a qualitative approach utilizing focus groups, student and staff interviews, and experience-based surveys, the barriers to student success for students with disabilities in higher education at the University of Arizona will be assessed through an intersectional and social justice model lens. Upon completion of data collection, a mitigative strategy informed by feedback and collaboration with on-campus disability resource organizations to increase equitable design will be implemented. This presentation will share study findings in relation to recent literature to show that while access has steadily increased over the past decade, higher education institutions can benefit from the implementation and dedication to equitable and universal design for learning frameworks. Further research into cost-efficiency, longevity, and satisfaction will be necessary to identify the full scope of total inclusivity for students with disabilities.

Keywords: Accessibility, disabilities, intersectionality, higher education, social justice model, mitigation, equitable design.

Dania Cruz-Jimenez

Psychology at University of Arizona

Mentored by Ruth M. López, PhD (Education)

Examining Resilience and Sense of Belonging in Latina Students at an HSI

This study focuses on intersectional experiences of Latina daughters of immigrants attending a Hispanic-serving Institution (HSI) in the Southwest. I explored gendered expectations, familial obligations, and the role of family in shaping both the resilience and sense of belonging of these students Specifically, this project aims to understand how Latinas in higher education handle competing expectations like academic achievement while navigating familial obligations. I will be drawing data from longitudinal interviews conducted at a university in the Southwest that is a Hispanic-Serving Institution. The data come from a larger study consisting of longitudinal interviews with a cohort of 10 Latina students who were a part of a Latina mentorship program and that were interviewed across the timespan of four years. Through narrative analysis, this study aims to contribute to a better understanding of the resilience in Latina students and show how certain factors can mitigate or hinder their connectedness to the institution they attend. This research is important because there has been a rise in Latina students in college and institutions should be able to properly accommodate for these changes. Enrolling students is not enough when institutions fail to properly accommodate for different cultural backgrounds which can harm students' trajectories and makes graduation less attainable. More research is needed in these areas to create a learning environment for Latina students to feel supported in their journey, feel a sense of belonging, and be successful professionals.

Keywords: Resilience, Latinx, Gender expectations, Family obligations, Family support, Sense of belonging

Elena Brown

Psychology | Criminal Justice at University of Arizona

Mentored by Jennifer Andews, PhD, MBA (Pediatrics)

Clinical and Economic Implications of Gastrointestinal Inflammation and Mental Health Condition Comorbidity in Adolescence and Young Adults in Hospital Care: A Cross-sectional Analysis with a focus on PTSD

The gut-brain axis is responsible for the bidirectional communication between the gastrointestinal (GI) system and the brain. Mental health conditions (MHC) such as anxiety, depression, or post-traumatic stress disorder (PTSD) have been shown to disrupt this communication, leading to worsened patient outcomes overall. This cross-sectional study examined national inpatient health insurance claims data from 2014 to 2021 to investigate how comorbid MHC and inflammatory gastrointestinal conditions (GI) influence hospital outcomes in adolescents aged 14-24 years. Among 2,615,592 cases analyzed, 11.2% had MHC with comorbid GI conditions (MHC-GI+), while 7.1% had GI conditions without MHC. Interestingly, there were no documented PTSD admissions at all found in the collected data, suggesting a significant underdiagnosis of PTSD in this population. The MHC-GI+ group demonstrated significantly worse clinical outcomes, with increased length of stay (11.61 days), ICU days (9.28), costs ($21,272.65), complications (3.5%), and mortality (0.8%) in comparison to other groups. These findings highlight the connection between GI and MHC comorbidity, as well as their association with worse clinical outcomes, when compared to an independent GI or MHC diagnosis. In addition, this research highlights the need for improved screening protocols to help identify GI and MHC comorbidity.

Ella Salem

Psychological Science, BS at University of Arizona

Mentored by John Ruiz, PhD and
Riley O'Neill (Psychology)

Exploring State Mindfulness and Disordered Eating Behaviors Using Ecological Momentary Assessment

Previous studies have found significantly high rates of disordered eating behaviors in college students, particularly women. Studies have also shown that mindfulness interventions can be effective in lowering and preventing these behaviors, as well as preventing overall anxiety in this population. Researching interventions for eating disorders is critical due to their high mortality rates. The current study examined these experiences using Ecological Momentary Assessment (EMA), a methodology not yet used to observe these relationships. Using EMA will allow researchers to observe the correlation between these symptoms and behaviors in real time by sending 18 hourly surveys across the span of two days. We hypothesized that lower self-reported mindfulness in daily life will be related to increased symptoms of affect, body-image dissatisfaction, binge-eating behavior, and loss of control in eating. We predict, however, that lower mindfulness will not be correlated with restrictive eating behaviors or may even increase this symptomatology. This study has run 122 diverse participants, including a high percentage of students identifying as Hispanic. Participants received both SONA credit and monetary compensation upon completing the study. The data is being analyzed using a lagged multilevel modeling approach. The use of this model will allow for the relationships between each time stamp to be analyzed separately within participants as well as between participants. This study was funded by participant support from the W.A. Franke Honors College Exploratory Mini-Grant and a student researcher stipend provided by the AWARDSS-Plus Program.

Gypsie Giroud

Psychology, BA at University of Arizona

Mentored by Michelle Perfect, PhD and Carolyn Tureaud (School Psychology)

Adolescent Type 1 Diabetes Quality of Life, Internalizing Symptoms, and Predicting Social and School Functioning

Chronic illness disrupts multiple aspects of an individual's life, including physical, mental, and emotional well-being, which can adversely affect school attendance and the overall learning environment (Thongseiratch & Chandeying, 2020). Type 1 diabetes (T1DM) is one of the most prevalent chronic medical conditions among school-aged students (Almeida et al., 2019), leading to a need for research in this area. This study aims to investigate whether diabetes-specific quality of life predicts adolescent self-reported interpersonal relationships and social quality of life, and whether diabetes-specific quality of life and internalizing predict school functioning. It is hypothesized that lower diabetes-specific quality of life will be associated with poorer interpersonal relationships and reduced social quality of life, and that both lower diabetes-specific quality of life and higher internalizing symptoms will be linked to diminished school functioning. With a quantitative approach, the Behavior Assessment Scale for Children-3rd Edition (BASC-3), Pediatric Quality of Life Inventory (PedsQL), both Diabetes and Core modules, and the PROMIS Anxiety and Depression scale will be utilized. Planned analyses of adolescent and parent responses include multiple regression models to assess the predictive value of diabetes-specific quality of life and internalizing symptoms on the identified outcomes. Findings are expected to inform accommodations for students experiencing chronic illness, specifically T1DM. Future research observing the perspective of students, families, and educators will help to create a comprehensive picture of how the education system can evolve to better support and encourage success among students T1DM.

Keywords: Diabetes, Chronic Illness, Quality of Life, Mental Health, Education, Youth

Julianna Celeste Molinero

Psychology | Leadership and Learning Innovation at University of Arizona

Mentored by Tamara Lawson, PhD (School Psychology)

Community Support and Self-Efficacy in First-Generation College Students of Color

Higher education has historically found ways to exclude students of color; yet more diverse students are finding the strength to continue their education despite these challenging barriers. Current literature has emphasized the need for college institutions to establish practices that help rectify these harmful circumstances. When composing changes and providing reinforcements, institutions often overlook the social and cultural experiences of students of color. These aspects are essential in designing culturally responsive support that can contribute to the strengthening of students' academic self-efficacy. The present study will examine the relationship between community support and self-efficacy in first-generation college students of color through semi-structured interviews with ten participants. During the interviews, questions will prompt participants to discuss their perceived academic self-efficacy, schooling experiences, and support they have received from their institution and community. By sharing these experiences, participants help to bridge the connection between cultural and academic experiences. Bandura's (1977) Social Cognitive Learning Theory and Yosso's (2005) Cultural Capital framework will be used to guide the analysis process and identify potential themes in the data. This study aims to convey the beauty of these experiences and acknowledge how listening to first-generation students of color can amplify inclusivity in college institutions.

Keywords: first-generation college students of color, community support, self-efficacy, cultural capital

Luthmila Natera

Teaching, Learning, & Sociocultural Studies
at University of Arizona

Mentored by Lillian Gorman, PhD
(Spanish & Portuguese)

Accommodating Neurodivergent Heritage Spanish Speakers in Higher Education Bilingual Programs

This project examines how higher education bilingual programs can better support neurodivergent heritage Spanish speakers. These students acquire Spanish in informal home settings and process information in ways shaped by neurodevelopmental conditions such as autism, ADHD, and dyslexia. In traditional language classrooms, they often face barriers such as inaccessible assessments, non-inclusive materials, and a lack of targeted academic and cultural support. This project draws on research in neurodiversity, inclusive pedagogy, and heritage language education to identify gaps in current practices and emphasize the need to address both the linguistic and cognitive needs of these learners. Using a Universal Design for Learning (UDL) framework alongside culturally sustaining pedagogy, this research proposes strategies that make instruction more accessible and identity-affirming. A planned qualitative study will explore the experiences of neurodivergent heritage speakers and their instructors in higher education settings. These insights aim to inform more equitable and responsive teaching approaches. By centering students who navigate both cultural and neurodivergent identities, the project underscores the importance of acknowledging diverse approaches to learning and engaging with Spanish. The findings will provide actionable recommendations for educators, curriculum designers, and institutions working to create inclusive bilingual environments where neurodivergent heritage speakers can succeed academically, develop their language skills, and affirm their cultural identities.

Neryanne Jinon

Neuroscience & Cognitive Science | Psychological Science at University of Arizona

Mentored by Andrew Gardner, PhD, BCBA-D, Maureen Galindo, and Annalysa Lovos (Psychiatry)

An Exploratory Investigation: Differences in Understanding of Autism Spectrum Disorder Between Japanese American and Filipino American Parents and the Influence on Help-Seeking Behavior

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder at least partially caused by a combination of complex genetic and environmental interactions. The expression of autistic traits is wildly variable and many families are affected by late or missed diagnoses which can delay the access to services. As some known causative gene variants are discovered, genetic testing services are now included in clinical guidelines for ASD. However, genetic counselors are often underutilized during the diagnostic process because often the complete genetic etiology remains unclear. Immigrant parents, specifically Asian Americans, face additional barriers to ASD services because of limited research on specific subcultures. This study aims to address the gap of research targeting specific Asian American subgroups, namely Japanese Americans and Filipino Americans, by means of a mixed-methods design. Qualitative measures adapted from Kleinman's (1978) Explanatory Model and Cultural Formulation Interview (CFI) were used for inductive-content and deductive-thematic analysis. Quantitative data were collected on ASD knowledge and stigma, adherence to cultural values, clinical severity/intensity of ASD symptoms, parental stress, and help-seeking behaviors then analyzed by Bayesian ANOVA. These preliminary data will help discover nuances and idiosyncrasies within the Asian American demographic. It is anticipated that a cultural framework of ASD detection, diagnosis, and treatment for other underrepresented populations can be informed with greater accuracy. This study also provides suggestions to emerging clinical fields, like genetic counseling, on how to increase the utility of their services to underserved cultural groups.

Keywords: autism spectrum disorder, cross-cultural psychology, genetic counseling

Stefanie Lukomski

Psychological Science at University of Arizona

Mentored by Jessica Andrews-Hanna, PhD, Shanshan Ma, and Melissa Reich-Fuehrer (Psychology)

The Effect of Adverse Childhood Experiences on Emotional Synchrony During Romantic Partner Interactions

Emotional synchrony is the physiological process in which two people affect one another's emotional state through self and coupled regulation. Adverse childhood experiences can trigger maladaptive development of affect and behavioral regulation that can continue through a lifetime and upend the ability to synchronize with a romantic partner. Engaging in interpersonal emotional regulation as a romantic couple, such as synchronizing with a partner, supports higher stress resiliency and mental well-being. One factor that has received little direct investigation is trauma from adverse childhood experiences as related to a romantic couple's ability to reciprocate in emotional synchrony. In this study, a sample of 149 couples (N=298 individuals) participated in supportive and disagreement topic discussion tasks in the lab. After the discussion, each participant watched a recording of their conversation and continuously rated their emotions. For each dyad, time-lagged emotional synchrony was then computed based on the paired emotion rating time series. Adverse Childhood Experiences Survey (ACES) was also completed to investigate the relationship between childhood trauma and maladapted development of dyadic synchrony. We hypothesize that the history of childhood trauma would affect emotional synchrony during interactions with the partner. This effect may be more prominent during the negative discussion. Even though couples show synchrony, individuals with childhood trauma would be less capable of acting as the leader or regulator who adjusts their emotion actively. We hope this study provides evidence underscoring the importance of investigating the long-term effects of maladaptive coping strategies stemming from childhood trauma.

Valeria Villagrana

Psychology, BA | Spanish: Interpretation and Translation emphasis at University of Arizona

Mentored by Norma Perez-Brena, PhD, John Ruiz, PhD, and Priscila Gamez Hernandez, MS (Psychology)

The Familial Influence on Educational Aspirations and Expectation: The Roles of Familism, Feelings of Support, and Family Routines

Due to barriers to education, such as reduced access to information about college, low socioeconomic status, and discrimination, Latine students are among the ethnic-racial groups least likely to attend and complete college. Therefore, it is important to better understand risk and protective factors that lead to this educational achievement gap to improve overall Latine social mobility. Previous research established the relationship between social support and positive educational outcomes, but little work has analyzed the influences of family on educational aspirations and expectations. Given the family-centered attitudes within Latine culture, further observations of familial influence are beneficial for this community. Familism pride, feelings of support, and family routines were used as measures of family influence. Belonging to a longitudinal study this cross-sectional sample of sixth and ninth grade participants were tasked with completing a self-reported survey. Data of the 453 adolescents who self-identified as Hispanic/Latine was utilized . Preliminary findings indicate that there is a significant positive correlation between familism pride and academic aspirations, but not expectations. Conversely there was a significant positive correlation between having consistent family routines and academic expectations, but not aspirations. Interestingly, both academic aspirations and expectations were not significantly correlated with the level of support youth received from their family. Future work should explore other aspects of the family such as family cohesion, family functioning, and the potential use of another measure of familism. Further research into these relationships is imperative as it could be used to inform family-based interventions to promote Latine student college attendance.

Minimizing Health Disparities (MHD)

Program Coordinator: Karla Smith, MPA
Professor of Practice: Caitlin Rosario Kelly, ABD
Sponsor: University of Arizona Graduate College

Akash Ahuja

Biomedical Engineering at University of Arizona

Mentored by Ravi Goyal, MD, PhD
(Obstetrics & Gynecology)

Fetal Heart Monitor for at Home Use

According to the CDC, stillbirth affects 1 in every 175 births, making it a major concern in maternal health (CDC, 2025). One of the best ways to monitor fetal health throughout the pregnancy is through monitoring the fetal heartbeat; however, there are currently limited ways to easily monitor the heartbeat at home. The goal of this project is to create a wearable fetal heart monitoring device that allows mothers to easily and accurately monitor fetal health in real time. The design of this device includes six microphones placed over the mother's stomach to track the fetal heart rate, along with one microphone over the mother's chest to capture her own heartbeat for noise reference and subtraction. Each of these microphones is connected to a low-pass filter and a digital noise filtering algorithm to isolate and clean the fetal heart signal. Additionally, the system is paired with a mobile app that allows the mother to view heartbeat signals and send real-time concerns to her healthcare provider if needed. While this device has not yet been tested on pregnant individuals, it has been evaluated on multiple adults as an electronic stethoscope and consistently produces clean heartbeats. These results show strong potential for the device to be used as an accurate, accessible tool to monitor fetal heart rate and detect abnormalities from home.

Bianca Baldeon

Pharmaceutical Sciences at University of Arizona

Mentored by Abhijit Date, PhD, MPharmSc and Manjusha Annaji (Pharmaceutical Sciences)

THE UNIVERSITY OF ARIZONA

Fabrication and Characterization of Soluplus-based Dissolvable Microneedle Arrays

Transdermal drug delivery is the passive diffusion of drugs through the epidermal layers of the skin. Microneedles allow drugs to bypass the stratum corneum barrier, minimizing negative side effects of the drug. Additionally, microneedles allow for a painless experience compared to injections, which often cause pain and fear for the patient. They also have benefits compared to oral administration, as drugs taken orally can have issues with absorption in the gastrointestinal tract. While there are challenges such as the placement, penetration, and effectiveness of drug delivery of these microneedles, we are researching effective polymers to diffuse drugs through the skin barrier for improved absorption and drug delivery. Microneedle arrays were fabricated from biodegradable polymers, specifically the amphiphilic polymer Soluplus. Soluplus is used because of its biocompatibility and biodegradability. It has good film-forming properties for microneedles that can improve a drug's stability. These microneedles will be evaluated for their mechanical strength, drug content, and insertion depth on the skin. In vitro skin permeation studies (n = 3) were performed using Franz diffusion cells which allowed us to observe a drug's potential skin permeation and retention over a 24 hour time period. Through the use of our fabricated microneedles, we aim to improve transdermal drug delivery, for the purposes of improving patient compliance by reducing frequency of administration and improving adherence to the therapy.

Ellerie Blomenkamp

Organismal Biology | Ecology & Evolutionary Biology
at University of Arizona

Mentored by John J. Wiens, PhD
(Ecology & Evolutionary Biology)

Geographic Patterns of New Clades as a Conservation Aid

We currently have little information on the geographic patterns of new clades (or new branches on the Tree of Life). These patterns are important to document as global diversity becomes increasingly threatened. Clades and higher taxa are especially important to conserve as they may represent higher diversity than species alone. This is because new clades may represent higher/older phylogenetic diversity than species alone. This study uses latitudes and continents in which new clades were found compiled from the years 2015-2020 via GBIF to study and compare geographic patterns among new clades. Using Excel, Desmos, R, and Google Maps, over 700 genera (only from 2020), 110 families, and 20 orders' latitudes and localities were catalogued and summarized. It was expected that most newly discovered clades would be constrained to the tropics via the latitudinal diversity gradient hypothesis, and while new genera followed this pattern, the highest proportion of new families and orders were found in the northern temperate zone. This may be due to sampling bias with higher speciation and thus lower-level taxonomic discoveries in the tropics or simply that the temperate zone has certain taxonomic ranks that are under researched. The most likely explanation is that scientists are studying microbes (far less diversity) at higher latitudes as there is more undiscovered diversity there. There is increasing concern that clades may go extinct without documentation/discovery and understanding the patterns among newly discovered clades will aid us in their conservation efforts.

Diana Bos

Neuroscience & Cognitive Science at
University of Arizona

Mentored by Henk Granzier, PhD and Catherine Hoover (Cellular & Molecular Medicine)

Analyzing the Role of MuRF1 and Titin in Early Muscle Atrophy

Muscle atrophy occurs when structural and contractile proteins are excessively degraded during chronic illness, aging, and bed rest, resulting in wasting and weakening of skeletal muscles. Although muscle atrophy is a significant public health issue, decreasing mobility and quality of life, its molecular mechanisms are not fully understood. Titin is an important structural protein in the sarcomere, the basic contractile unit of skeletal muscle, and contains a MuRF1 binding site. MuRF1, an E3 ubiquitin ligase, drives atrophy by ubiquitinating sarcomeric proteins, including titin, which targets them for degradation by the proteasome and autophagy systems. We hypothesized that titin's interaction with MuRF1 is important for the initiation of titin degradation, which is thought to destabilize the sarcomere, promoting atrophy. To investigate the interaction between titin and MuRF1, a genetically engineered mouse model was developed in which titin's MuRF1 binding site is altered. This modification blocks MuRF1's ability to bind, which we hypothesized would attenuate degradation. To evaluate our hypothesis, we performed unilateral sciatic nerve transection (sciatic denervation, SD) on wild-type and mutant mice to induce atrophy. Gastrocnemius tissue was harvested after seven days from the denervated (right) and the control (left) legs. Tissue was solubilized and fractionated to quantify the ubiquitination of sarcoplasmic and myofibrillar proteins, focusing on titin, by Western blot. We expect that mutants will have reduced ubiquitination levels in the SD gastrocnemius (relative to the control leg) compared to the wild-type mice, suggesting that the titin–MuRF1 interaction is a viable therapeutic target for future studies.

Enrique Caperon

Neuroscience & Cognitive Science at
University of Arizona

Mentored by John Allen, PhD and
Kelly Chen (Psychology)

Grief: How the Grieving Brain Functions and Implications on Behavior

Losing a loved one is a universal trigger for grief. Persisting grief disrupts cognitive processes and leads to functional impairment; this is classified as Prolonged Grief Disorder (PGD). One proposed theory for PGD is the disruption of one of three core processes that allow grieving individuals to accept the loss: (a) insufficient integration of the loss into the autobiographical knowledge base, (b) negative global beliefs and misinterpretations of grief reactions, and (c) anxious and depressive avoidance strategies (Boelen et al., 2006). During periods of grief the action monitoring system functions predictably atypical. This current study investigates action monitoring activity, specifically, two event-related potential (ERP) components called N2 amplitude and mid-frontal negativity, and mid-frontal theta power, a neural marker for cognitive control. These frequencies have been implicated in the action conflict process in recently bereaved individuals. Eligibility included having lost a loved one within the past 6 months to 2.5 years. Electroencephalographic (EEG) data were recorded while participants completed a mean reaction time assessment, a modified Simon task, and a grief-specific task. These tasks support the goal of this study to better understand the grieving brain's response to stimuli that both relates and does not relate to the recent loss. This study is still in progress but marks a first of its kind in EEG research with long term implications in healthcare's approach to guiding bereaved individuals through the grieving process in a normative way. Grief is unavoidable, but it does not have to be detrimental.

Trisha T. Dang

Molecular & Cellular Biology at University of Arizona

Mentored by Guang Yao, PhD and Qiong Pan
(Molecular & Cellular Biology)

The Effects of Glucose on Cellular Quiescence Depth

Quiescence is a reversible state of growth arrest with varying depths, where a deeper quiescence is more difficult to push back into the cell cycle than a shallower quiescent cell upon growth signals. Understanding how glucose levels affect quiescence depth within mammalian cells is critical to many physiological and pathological processes within cancer research, specifically chemotherapy where drugs are effective against growing cells but not quiescent cells. Although existing studies address similar topics, they fail to specify how glucose availability influences the varying depths of quiescence. Our project observes the effects of low glucose levels on quiescence depth within rat fibroblast cells, consisting of trials utilizing a high glucose serum starvation and stimulation, a low glucose serum starvation with a high glucose serum stimulation, and a low glucose serum starvation and stimulation. An EdU incorporation assay was used to quantify the proportion of cells that reentered the cell cycle following treatment, allowing us to measure quiescence depth. We found that cells undergoing high glucose starvation tend to enter shallower quiescence, whereas cells that underwent low glucose starvation entered deeper quiescence. These findings suggest that low glucose levels promote deeper cellular quiescence, offering potential for improved cancer treatment. Specifically, maintaining adequate glucose levels prior to undergoing chemotherapy would likely keep cancer cells in shallower quiescence, making them more susceptible to treatments and potentially improving its efficacy as well.

Chaz DeCoteau

Biochemistry | Pharmaceutical Sciences at University of Arizona

Mentored by Samuel Campos, PhD and Zachary Williamson (Immunobiology)

Using Co-Immunoprecipitation to Investigate the Potential for SNX1.3 to Disrupt the Interaction Between p120 Catenin and L1

Human papillomavirus (HPV) infections are responsible for 99% of cervical cancers and 80% of mouth and throat cancers in the U.S. With a vaccine that only covers half of the high risk strains, and that is too expensive for low income regions of the world to fully access, low vaccination rates persist, increasing the prevalence of HPV-related cancers from strains such as HPV16. In this project, we aim to see if the SNX1.3 peptide, known to inhibit HPV infection, disrupts the interaction between the HPV L1 protein and p120 catenin, which initiates the process for HPV to guide itself to the nucleus to establish infection. With co-immunoprecipitation, we use antibodies to isolate p120 in complex with L1 in HaCaT cells infected in the presence of SNX1.3. We also use the same method to isolate other binding partners of p120 in order to monitor the efficacy of the technique. Immunoprecipitates of p120 isolated minimal amounts of the protein, with a majority of the protein remaining unbound. This has made it difficult to identify p120. Adjustments to the protocols have changed incubation durations and temperatures, but have minimally improved results. Future attempts with this technique will use more antibodies with larger protein concentrations, to increase the amount of p120 that can be isolated. If this works, it will allow us to better visualize the HPV L1-p120 complex, and thus how this interaction is affected by the presence of SNX1.3.

Gabriel Encinas

Molecular & Cellular Biology at University of Arizona

Mentored by Cynthia Miranti, PhD (Cellular & Molecular Medicine)

Alteration of Snail Expression Potential in Prostate Cancer Inducible -Snail Expression Models

Layla Flores

Biology: Biomedical Sciences emphasis at University of Arizona

Mentored by Noel Warfel, PhD and Hope Liou (Cellular & Molecular Medicine)

Comparing the Efficacy of PIM447 vs PIMTAC and Their Effects on Autophagy

Prostate cancer is the 2nd most common cancer for men in the United States. The proviral integration for the Moloney murine leukemia virus (PIM) were first discovered as oncogenes, potentially cancer-causing genes, in blood cancers. PIM kinases are overexpressed in many solid tumors which is linked to poor survival in several types of cancer, including prostate cancer. PIM kinases are a group of serine/threonine kinases that include three different isoforms, PIM1/2/3. PIM kinases regulate many signaling pathways, including cancer cell survival and migration. PIM1 alters autophagy, the process that cells use to degrade and reuse cellular components. Over the years, scientists have developed drugs targeting the catalytic activity of PIM kinases. We observed that PIM inhibitor treatments, such as PIM447, increase PIM protein stability and thus increase activation of PIM1 downstream pathways. Proteolysis-targeting chimeras, PROTACs, are drugs that are designed to degrade specific proteins. The lab created a PIM targeting drug, named PIMTAC. Using western blotting, we compared the efficacy of PIM degradation between PIMTAC and PIM447. We assessed how PIM447 and PIMTAC affect autophagy. Our results validate that PIM inhibitors stabilized and increased PIM levels and increased autophagy. However, PIMTAC decreased PIM levels by specifically degrading PIM but decreased autophagy. Future research will deepen our understanding of how PIMTAC and PIM inhibitor treatment alters autophagy, with the aim to increase sensitization of prostate cancer tumors to chemotherapy. This research advances PIMTAC towards future clinical trials and personalized treatment.

Jahaziel E. Galvan

Optical Sciences & Engineering at University of Arizona

Mentored by Russell S. Witte, PhD, Rianne Hilkemeyer, Margaret Allard, Nadia Farha, Parker Harris, Zoe Huestis, and Armenta Emilio (Medicine)

Photoacoustic Imaging and Spectroscopy in Quantifying Soft Tissue Constituents for Better Diagnosis of Cancer

Lipids, Water, and Collagen (LWC) are key components of biological tissue that are linked to cancer, yet imagining LWC remains a challenge in biomedical optics. Current lung cancer detection techniques such as X-ray, PET, and MRI have limitations which include false positives, limited specificity, and cost. A less common but promising alternative is Photoacoustic Imaging (PAI). PAI is a method of using pulsed light to generate ultrasound waves in tissue based on optical absorption. This allows for deeper imaging and molecular level contrast. However, PAI has its own limitations in shallow penetration, spectral overlap, and low molecular specificity. Short Wave Infrared Photoacoustic Imaging (SWIR-PAI) improves contrast and specificity by leveraging distinct absorption peaks of LWC in the SWIR range. Using SWIR-PAI my team created two sets of phantom samples, one containing different percentages of agarose and gelatin power and the other with agarose-gelatin power and varying components of an egg. These phantom samples were then scanned using SWIR-PAI to collect Pulse Echo, Volumetric, and Spectral scans to form images. At a wavelength of 1780 nm, the results indicated a 49.4% difference in photoacoustic averages between the 99% water sample and the sample containing a 20% gelatin gel mixture. For future goals using either mouse models or human tissue samples would be ideal for future studies that can be put towards cancer diagnosis and treatment.

Carson Garcia

Molecular & Cellular Biology at University of Arizona

Mentored by Jesse Woodson, PhD
and Matthew Lemke (Plant Science)

A Root Awakening: Reactive Oxygen Species as a Molecular Messenger in Plants

Many scholars, such as Jesse Woodson and Matthew Lemke, have worked to identify the molecular mechanisms of plant abiotic stress responses, particularly the responses brought on by an accumulation of reactive oxygen species (ROS) in plant tissues. However, the identification of root tissue specific genes is crucial to filling in holes in the complete picture of plant stress mechanisms. This study investigates the identification of root tissue specific genes in Arabidopsis thaliana and how we can use them to induce waves of ROS to trigger stress responses, even when no natural stress signal is present, like high heat or extensive drought. By using tissue specific promoters of potential tissue specific genes conjugated to ROS producing fluorescent proteins, we can create lines of plants that contain these ROS producing genes and look at them under microscopes that cause the fluorescent proteins attached to the ROS producing proteins to glow. I used multiple combinations of tissue specific promoter combinations, but this study will be focused on the pADH1::KillerOrange gene conjugation and pSCR::Killer Orange gene conjugation. I screened through over 100 lines of plants that have already been transfected with these gene conjugations to look for good expressors of the conjugations. This resulted in the identification of potential lines of A. thaliana that show high levels of clear expression. While the findings of this study were possible due to years of research that came before, the identification of these genes takes us one step further in understanding the molecular mechanisms plants use to protect themselves in an ever changing environment.

Grace Ho

Psychological Science at University of Arizona

Mentored by Lee Ryan, PhD, Stephanie Matijevic, and Lesley A. Guareña and Lesley A. Guareña (Psychology)

Understanding Risk and Resilience Factors of Cognitive Aging

Cognitive changes in aging can lead to a compromise in quality of life, such as impaired memory and ability to perform daily tasks. With an increase in the older adult population, it is more relevant and urgent than ever to understand how cognitive aging works. In order to develop preventions and interventions against significant age related cognitive decline, it is crucial to study factors that contribute to cognitive aging. Therefore, our study aims to understand cognitive aging, specifically why certain individuals are at greater risk of cognitive decline while other individuals are more resilient. In this study, older adult participants (ages 50-79) are given a variety of neuropsychological and behavioral assessments in different cognitive domains, such as memory and attention. Factors that impact cognitive aging, such as brain health, vascular health, genetics and other health and lifestyle factors are also assessed through methods like neuroimaging, carotid artery ultrasounds, blood draws and self-report questionnaires. Altogether this comprehensive dataset allows us to examine the relationships between cognitive aging and potential risk and resilience factors, which may enable earlier identification of people at risk of significant cognitive decline, earlier intervention, and better long-term health outcomes.

Domonique Houston

Pharmeceutical Sciences at University of Arizona

Mentored by Michael D. L. Johnson, PhD and Meredythe Durckel (Immunobiology)

Evaluating Metal Susceptibility with Compounds in Enterobacter aerogenes and Pseudomonas aeruginosa

Hospital-acquired infections account for approximately 450,000 cases annually in the United States, including catheter-associated urinary tract infections caused by *Enterobacter aerogenes* and *Pseudomonas aeruginosa*. These pathogens are a critical public health concern due to their significant resistance to antibiotics. Transition metals such as copper and zinc exhibit antimicrobial activity; however, the most optimal concentrations and synergistic effects with compounds remain undetermined. This study assesses metal tolerance of *E. aerogenes* and *P. aeruginosa* under three conditions: (1) exposure to copper and zinc alone, (2) co-treatment with DMDC and BMDC compounds, and (3) growth in minimal media to determine their individual susceptibilities. Growth curves were generated using 96-well dilution plates across all conditions. Comparative analysis suggests that co-treatment with compounds reduces the copper concentration required to suppress bacteria growth. These findings support the development of metal-infused therapeutic strategies aimed at lowering nosocomial infection rates.

Parker Hubbell

Neuroscience & Cognitive Science
at University of Arizona

Mentored by Elizabeth Hutchinson, PhD
(Biomedical Engineering)

Histopathology of Tau Biomarker Correlation with Diffusion Tensor Imaging of Hippocampal Brain Regions

Diffusion Magnetic Resonance Imaging has been widely utilized in neuroscience to measure water diffusivity as a way to probe microstructure in brain tissue. However, the Tau biomarker seen in Alzheimer's Disease is not specifically measured by diffusion MRI. This study attempts to understand the radiologic-pathologic correspondence between the Tau pathology in Alzheimer's Disease and MRI diffusion tensor imaging by examining percent area of Tau staining and MRI metrics within different subfields of the hippocampus in human subjects. Using microscopy of nine postmortem human temporal lobe specimens and particle analysis of Tau staining within their hippocampal subfields, I can explore correlation of biomarker percent area and fractional anisotropy, propagator anisotropy, and bound pool fraction values reported as R-squared correlation values. This study found that propagator anisotropy is strongly correlated with percent area of Tau staining in hippocampal regions with an R-squared value of 0.5428 in Dentate gyrus and 0.5776 in CA1. This study suggests further connection in structural brain imaging and microstructural characteristics of brain degradation. This study brings attention toward microstructural imaging of Alzheimer's Disease, and the future implications of this study will lead to earlier advancements of neurodegenerative disease diagnosis for clinical patients.

Nataly A. Karlinsey

Biology: Biomedical Sciences emphasis at University of Arizona

Mentored by Alexander McGhee, PhD and Gabriel Declercq (Biomedical Engineering)

Spatially Patterned Growth Factor Release from Liquid-Like-Solid (LLS) Scaffolds

Spatiotemporal gradients of growth factors such as epidermal growth factor (EGF) and fibroblast growth factor-2 (FGF2) critically influence cellular differentiation and organization of Human umbilical vein endothelial cells (HUVECs). Cellular fate is highly dependent on the localized and timed distribution of these growth factors, yet traditional in vitro culture systems often neglect this spatial and temporal complexity. To overcome these limitations, we employ a 3D hydrogel scaffold system known as liquid-like-solid (LLS), designed to precisely control the spatial context of cell signaling by controlling the free convection in the extracellular environment. StemBeads (PLGA microspheres that enable localized, sustained release of growth factors) are embedded within LLS hydrogel granules and act as a continuous source for each growth factor type. Using this system we create controlled spatiotemporal diffusion gradients. Using in-situ ELISA beads distributed throughout the LLS, we are able to quantify the concentration-time profile of EGF and FGF2 throughout the environment. HUVECs, cultured within this environment, respond dynamically to these gradients. We hypothesize that HUVEC cells will differentiate and self-organize into vessel-like structures, specifically guided by the spatially distributed concentration-time profiles of EGF and FGF2. This innovative approach serves as the basis to build more physiologically relevant models, enhancing the understanding of angiogenic processes, with direct applications in cancer research and regenerative medicine.

Caleb Matthew Carl Konecek

Biochemistry | Molecular & Cellular Biology | 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 promotes 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 cytoskeletal protein rearrangement, though its precise role in these processes remain unclear. Recently, we have identified the small GTPase Rap1 as a binding partner of the SIN1 component of mTORC2, and preliminary experiments have linked Rap1 overexpression to increased mTORC2 activity in mammalian cells. Additionally, evidence suggests that the membrane phospholipid PI(3,4,5)P3 (PIP3) similarly regulates mTORC2 activity by promoting membrane binding, 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 precise regulation. Our research attempts to clarify their relationship as binding partners of SIN1 to provide further 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 indicates that Rap1 and PIP3 regulate mTORC2 activity in an additive fashion, but further research is necessary to determine their roles in its localization in cells.

Sarah Lind

Biology at University of Arizona

Mentored by Diane Thompson, PhD and Mudith Weerabaddanage (Geosciences)

Reconstructing 2016 ENSO Variability from Subfossil Corals in the Marshall Islands

The reliability of established climate proxies from subfossil corals has been widely debated in Paleoclimatology, especially under varying climate conditions such as the El Niño–Southern Oscillation (ENSO). These coral records are important for understanding past oceanic conditions and informing projections of future climate change. However, researchers have lacked subfossil coral data from the past 30 years due to difficulty locating datable material and a broader focus on longer paleoclimate timescales. This project evaluates how well subfossil coral proxies capture sea surface temperature (SST) and sea surface salinity (SSS) in the Republic of the Marshall Islands, focusing on the year 2016. SST and SSS are key variables because they directly influence coral geochemistry. Metal ratios and oxygen isotope values in coral skeletons reflect these conditions, Li/Ca and Li/Mg relate to SST, while $\delta^{18}O$ is a proxy for SSS. ENSO strongly affects SST and SSS in the central Pacific, so analyzing a highly variable ENSO year like 2016 helps with determining the effectiveness of subfossil corals for climate reconstruction. I analyzed *Porites* coral samples from a Marshall Islands core using milling, weighing, and geochemical analysis, then compared results to instrumental SST and SSS data from Arno Atoll. Li/Ca, Li/Mg, and $\delta^{18}O$ values aligned well with instrumental data, confirming their value as paleoclimate proxies. These findings justify the use of fossil corals for recent reconstructions and highlight the need to improve ENSO paleoclimate models to better understand and prepare for future climate change.

Ash Maxwell

Applied Biotechnology at University of Arizona

Mentored by Liliana Salvador, PhD and
Sarita Bugalia, PhD (Animal & Biomedical Sciences)

An Age and Sex Structured Disease Model: Bovine Tuberculosis in Deer

Bovine tuberculosis (bTB) is a zoonotic disease that is caused by the bacteria *Mycobacterium bovis*. In the United States, bTB is currently endemic to the northeastern lower peninsula of Michigan where white-tailed deer (*Odocoileus virginianus*; deer) act as a wildlife reservoir for the disease. To evaluate how bTB spreads within the deer population, we developed a Susceptible, Exposed, Infected (SEI) disease transmission model structured by both age and sex. To our knowledge, no prior SEI models have been modeled for bTB in white-tailed deer populations that utilize both age and sex as factors. Age and sex may play a critical role in understanding bTB dynamics due to the influence they can have on differing social structures and behaviors across a deer's lifetime. We fitted the model using voluntary testing data from hunted or harvested deer collected during 1994-2023. Our analysis focused on the counties of Alcona, Alpena, Montmorency, and Oscoda, which are the counties with the highest prevalence of bTB, with very few cases occurring in proximal counties. The results from this fitted model have the potential to inform future bTB wildlife management strategies in Michigan and serve as a framework for similar efforts in other regions.

Fabiola Mendoza

Applied Biotechnology | Biology: Biomedical Sciences emphasis at University of Arizona

Mentored by Paul R. Langlais, PhD and Mary Catherine Roa (Medicine)

The Link Between Inflammation and Insulin Resistance: How TAK1 and Microtubule Dynamics Affect Glucose Transport

Insulin-stimulated glucose uptake (ISGU) is essential for maintaining blood glucose homeostasis and occurs mainly in insulin-sensitive tissues such as skeletal muscle and adipose tissue. ISGU depends on dynamic microtubules that transport GLUT4-containing vesicles to the plasma membrane, where GLUT4 allows glucose to enter cells. In insulin resistance, a characteristic of type 2 diabetes (T2D), this process is compromised, leading to reduced glucose uptake and elevated blood sugar. Chronic inflammation, often linked to obesity and metabolic stress, is a major contributor to insulin resistance. Inflammatory cytokines such as tumor necrosis factor-alpha (TNF-alpha) disrupt insulin signaling and activate stress-responsive kinases, including Transforming Growth Factor-beta Activated Kinase 1 (TAK1). TAK1 is a MAP3K that integrates inflammatory signals and regulates downstream stress pathways. Recent studies show that TAK1 phosphorylates alpha-tubulin acetyltransferase 1 (ATAT1) at serine 237, increasing its activity. ATAT1 acetylates alpha-tubulin at lysine 40, stabilizing microtubules. While acetylation strengthens microtubules, we hypothesize that inflammation-induced hyperacetylation limits their dynamic behavior, reducing GLUT4 trafficking and glucose uptake. Our results show that increased microtubule stability impairs ISGU and disrupts insulin signaling. These effects resemble the impact of chronic inflammation, where cytokine-driven TAK1 activation enhances ATAT1 activity. This suggests that inflammation not only interferes with insulin signaling pathways but also disrupts the microtubule system required for GLUT4 movement. By studying the TAK1-ATAT1-microtubule pathway, we aim to clarify how inflammation impairs glucose transport and identify potential therapeutic targets to improve insulin sensitivity in T2D.

Mara Navarro Perez

Biochemistry | Microbiology at University of Arizona

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

Prevalence and Characterization of Clostridioides difficile in Tucson

The Centers For Disease Control and Prevention currently lists *Clostridioides difficile* Infection (CDI) as the most prevalent healthcare-associated infection (HAI) in the United States. As a result, this costs the United States $5 billion annually. *C. difficile* surveillance studies are conducted to understand the prevalence of this bacteria in healthcare settings. 277 to-be-discarded stool samples and their respective GDH/Toxin ELISA diagnostic test results, dates, and ward information were collected from Banner Medical Center (BMC) patients with clinical suspicions of CDI. Taurocholate-Cycloserine-Cefoxitin-Fructose Agar (TCCFA) media was used to isolate *C. difficile* from GDH+/Tox+, GDH+/Tox-, and GDH-/Tox- stool samples to determine the prevalence of *C. difficile*. This surveillance study found a total of 82 (29.60%) samples that tested positive for *C. difficile* presence using ELISA results and TCCFA media. ELISA tests alone detected 66 (23.83%) total positive samples, whereas TCCFA media isolated 75 (27.08%) cultures of *C. difficile* from the 277 total samples. TCCFA media was unable to recover C. difficile from 7 ELISA-positive stool samples. Based on the results, ELISA diagnostic testing and TCCFA media selection may not detect nor isolate all *C. difficile*-positive stool samples. Examining these data will help elucidate the prevalence of *C. difficile* infections in Tucson and better inform clinical decisions.

Brandon S. Rodriguez

Neuroscience & Cognitive Science at University of Arizona

Mentored by Haijiang Cai, PhD and Maša Miščević (Neuroscience)

Optogenetic Activation of PKC-delta (-) Neurons and Satiation in the Central Nucleus of the Amygdala

Eating is an essential part of our everyday lives, and the decision when to stop eating involves coordination of many circuits. Previous work by Dr Haijiang Cai established PKC-delta neuronal circuitry in the central nucleus of the amygdala (CeA) responded to the gut hormone cholecystokinin (CCK) which is a known appetite suppressant used to mediate satiation by inhibition of PKC-delta(-) neurons caused by PKC-delta(+) neurons. We seek to understand the pathways downstream of the CeA which mediate this signal. In addition, work by Marina Rodriguez Sanchez and Dr. Haijiang Cai, Marina found during cFOS staining in the brainstem that after unilateral optogenetic activation of CeA PKC-delta(+) neurons, there was inhibition of CeA PKC-delta(-) which were found to activate the parasubthalamic nucleus (PSTh). Our hypothesis is that optogenetic activation of CeA PKC-delta(-) neurons inhibits PSTh neurons and causes a hunger-like response. We use viral retrograde tracing from PSTh neurons to identify its PKC-delta neuron synaptic partners, and channel rhodopsin insertion in PKC-delta neurons to optogenetically manipulate them. When we optogenetically activate PKC-delta(-) neurons, we are expecting to see an increase in food intake as we intercepted the natural satiation pathway, causing the mice to be less full and eat more. By looking at how these pathways interact with each other, we can get a better view of how our body regulates satiation.

Kristen Saunders

Speech, Language, and Hearing Sciences at University of Arizona

Mentored by Meghan Darling-White, PhD, CCC-SLP and Trianna Oglivie (Speech, Language, and Hearing Sciences)

Exploring Self-Efficacy and Communicative Participation in Adolescents with Down Syndrome: A Qualitative Study of The Caregiver Perspective

Self-efficacy has been suggested as a mediator of successful communicative participation. Communicative self-efficacy, defined as one's belief in their ability to effectively communicate, directly influences the extent to which an individual engages in and across social and functional contexts. There is a notable gap in the literature regarding self-efficacy in adolescents with Down syndrome, a group frequently underrepresented in research. The purpose of this study was to gain insight into the ways in which self-efficacy can either facilitate or inhibit successful communicative participation in adolescents with Down syndrome. We conducted semi-structured qualitative interviews with the caregivers of two young adults with Down syndrome. Interviews were audio-recorded and transcribed to complete a full analysis and identify themes of self-efficacy. By understanding that adolescents with Down syndrome possess varying levels of self-efficacy, this study explores how these differences can both facilitate and inhibit communicative participation, highlighting the individualized nature of their communication experiences. This paves the way to targeting self-efficacy in speech therapy as a tool for successful confident communication in adolescents with Down syndrome.

Easton Setzer

Biology at University of Arizona

Mentored by Alexander Bucksch, PhD and
Alan Cervantes (Plant Science)

THE UNIVERSITY OF ARIZONA

Exploring Effects of Drought on Sorghum Root Anatomy

Sorghum (Sorghum bicolor (L.) Moench) is a bioenergy crop that exhibits a remarkable tolerance to drought conditions. One of its fascinating mechanisms to survive the harsh desert environment is its ability to control the die off cortical cells to reduce the metabolic energy needed to sustain the organism. However, the extent at which cortical cells die off in the bioenergy sorghum, a variant that only produces green biomass and does not flower, is unknown. Therefore, we measured the metaxylem vessels in the roots to understand if drought changes plant vasculature in response to drought. We scored the extent of cortical cell loss and counted metaxylem number and compared non-limiting growth conditions to drought growth conditions. In total we obtained 108 root samples across three different genotypes and 6 time points of sorghum development. Root samples were micro dissected, dyed, and imaged with an inverted backlight microscope. Our findings suggest that cortical cell loss is less severe in non-limiting conditions in bioenergy sorghum compared to drought conditions. We furthermore observed that less metaxylem are present in droughted plants. The findings will help to optimize management of bioenergy sorghum fields and help to develop more efficient bioenergy sorghum cultivars to become less dependent on unsustainable fossil fuels.

Joelle Smith

Biochemistry | Chemistry | Molecular & Cellular Biology
at University of Arizona

Mentored by Thomas L. Gianetti, PhD, Savannah Stull, David Mills, Robert Lozanovski, and Ramandeep Kaur (Biochemistry & Chemistry)

Triaryl Carbenium Ions: Applications in Tethered Metallaphotoredox Catalysis

Photocatalysis, a cyclic process that involves light activating a catalyst by being absorbed, has been around for the past century and is known for aiding many organic reactions. It helps decrease reaction times and overcome activation energy barriers that would otherwise be too high. Photocatalysts are derived from either organic molecules or transition metals. The modern-day problem for the field of photocatalysis is in figuring out how to make these photocatalytic reactions more efficient and versatile for the purpose of branching out into different fields of science; such as material chemistry, medicine, and environmental remediation. In an effort to address this, we have dived into the realm of methodology where researchers are tethering two different catalysts together to increase the efficiency of both by using triaryl carbenium ion structures. Tethering can reduce catalytic loading requirements and unlock new organic transformations not possible with their un-tethered counterparts. Functional groups added to these triaryl carbenium ions play a critical role in deciding the fate and function of these catalysts and are the most common variable being changed. Overall, tethering catalysts can turn basic photocatalytic structures into complex ligands able to accelerate chemical reactions and provide a more efficient pathway to solving many reaction problems.

Emma Smith

Neuroscience & Cognitive Science at University of Arizona

Mentored by Torsten Falk, PhD and Raveena Parmar
(Neurology and Pharmacology)

Evaluating the anti-dyskinetic activity of low-dose ketamine in the context of the BDNF Val66Met Polymorphism

Parkinson's disease (PD) is a progressive neurodegenerative disorder that initially presents with subtle non-motor symptoms, such as depression and sleep disturbances. By the time hallmark motor symptoms like tremor and rigidity emerge, significant loss of about 70% of dopaminergic neurons has already occurred. While Levodopa (L-DOPA) remains the gold standard for motor symptom relief, it does not address non-motor symptoms or halt disease progression. Prolonged use of L-DOPA frequently leads to L-DOPA-induced dyskinesia (LID), affecting over 90% of patients. Our lab previously demonstrated that sub-anesthetic ketamine (5 × 20 mg/kg, i.p. over 10 hrs) reduces LID and exhibits acute antiparkinsonian effects in 6-hydroxydopamine (6-OHDA)-lesioned male rats. We also showed that the anti-dyskinetic effect of ketamine is attenuated by pharmacological blockade of the BDNF receptor TRKB using ANA-12, implicating BDNF-TRKB signaling. Notably, ~20% of the global population carries the BDNF Val66Met (rs6265) polymorphism, which impairs activity-dependent BDNF release and may alter treatment response. This study investigates whether the Val66Met SNP affects ketamine's anti-dyskinetic efficacy using a CRISPR knock-in rat model. Male transgenic rats will receive unilateral 6-OHDA lesions and be randomly assigned to ketamine or vehicle groups. After lesion verification, animals will receive weekly ketamine (20 mg/kg) or saline treatments, followed by L-DOPA. AIMs will be assessed every 3–4 days over 14 days. This work addresses a key gap in understanding how genetic factors influence treatment response in LID and evaluates the translational potential of ketamine as a personalized therapy.

Mandy Wu

Pharmaceutical Sciences at University of Arizona

Mentored by Tally Largent-Milnes, PhD and Sophia von Hippel (Pharmacology)

Bisphenol A and Photophobia: Dose-Response Curve in Female Adult Rats

Bisphenol A (BPA) is a synthetic estrogen commonly found in food packaging. Humans are chronically exposed to low doses of BPA. Acute doses of BPA exacerbate migraine symptoms, but little is known about the effects of chronic BPA exposure on migraine. Due to differences in hormonal tone in the modulatory pain circuit, women are twice as likely as men to be diagnosed with migraine disorders. In the Largent-Milnes lab, I assisted a graduate student in researching the effects of chronic low-dose BPA on behaviors associated with migraine and on hormonal signaling in the pain circuit. We conducted a dose-response curve, and I analyzed the impacts of BPA on photophobia (sensitivity to light, common in migraine). We administered 3 doses of BPA to rats orally via treats given at 2 p.m. daily. Then, we conducted a light/dark behavioral assay to assess photophobia. We found statistically significant dose-dependent changes in photophobic behavior. This study not only contributed to a scientific gap regarding the role of hormones in pain modulation, but also, for the first time, elucidated the effects of chronic low-dose BPA on behaviors associated with migraine.

Ronald E. McNair Postbaccalaureate Achievement Program (McNair)

PI/Program Director: Caitlin Rosario Kelly, ABD
Administrative Assistant: Tori Juvera
Graduate Teaching Assistant: Astrid Liu, MFA
Sponsors: U.S. Department of Education, Federal TRIO Program, Ronald E. McNair Postbaccalaureate Achievement Program (Award: #P217A220105), University of Arizona Graduate College

Collin Brown

Neuroscience & Cognitive Science | Molecular & Cellular Biology at University of Arizona

Mentored by Melville Wohlgemuth, PhD (Neuroscience)

Sequential Control of Spatial Orienting Behaviors During Dynamic Movements

We live in a complex sensory environment, and the brain must filter incoming information to guide adaptive behavior. Under natural conditions, the brain supports short-term and long-term control of goal-directed actions. Humans rely heavily on vision for active sensing, selectively attending to relevant stimuli and ignoring visual clutter. In contrast, echolocating animals like bats adapt these active sensing behaviors through auditory information returning from the environment. By emitting vocalizations and analyzing returning echoes, bats dynamically reorient to avoid obstacles and navigate cluttered environments. In previous research on stationary bats, we stimulated the brain to drive a sequence of orienting behaviors, specifically stimulating the superior colliculus, a midbrain structure important to spatial attention behaviors. Here, we investigate whether bats naturally perform similar behavior sequences during free flight. We trained Mexican free-tailed bats (*Tadarida brasiliensis*) to navigate a controlled flight space under open-air and cluttered conditions. Sonar call production was recorded using a single ultrasonic microphone, while 3D motion capture (16-camera system) tracked head, ear, and body movements. We analyzed behavioral components such as head and ear movements and sonar call production to characterize how the bat sequences its natural behaviors when changing spatial attention. This study provides a foundation to analyze how targeted brain stimulation during natural flight could modulate orienting behavior sequences. Ultimately, our work contributes to understanding the neural basis of active sensing and spatial attention in dynamic, real-world settings.

Leelu Cervantes

Psychology at University of Arizona

Mentored by Daniel Sullivan, PhD and Alexis Goad (Psychology)

How History Shapes Perception: Understanding Different Perceptions of the Native American Identity

Due to settler colonial endeavors, Native American people have faced a history of removal from ancestral lands and attempts at total elimination. The impacts of these endeavors have led the general US population to have varying exposure to authentic contemporary Native American people, depending on the sociopolitical histories of the geographic region. This research explored how these unique histories impact non-Natives' perceptions of the Native American identity. A total of 137 participants who identified as non-Native were collected from Indiana (a removal state), Arizona (a reservation state with low Native/non-Native overlap), and Oklahoma (a reservation state with high Native/non-Native overlap). Participants were asked to complete a two-item free-response survey regarding their expectations about Natives. Using thematic analysis, we were able to compare prevalent themes from each state. Our findings indicate that while no state is truly unique, each state's responses were indicative of its relationship with natives, each offering a different perspective. Oklahoma's themes revealed the integrated nature of the communities, whereas Indiana had more superficial perceptions, often drawing from cultural narratives and media. Arizona's themes had much more variance, thus serving as a bridge between Indiana and Oklahoma.

Casandra Chavarria

Psychology at University of Arizona

Mentored by Anna Ochoa O'Leary, PhD
(Mexican American Studies)

Buscando el Sueño Mexicano: The Educational Goal Setting Behaviors of Mexico's Returning Students

Although research on the returned student population has increased over the last few years, there has been little to no research conducted on the educational goal setting behaviors of returned students and their role in student's academic achievement. Using a mixed-methods approach, a semi-structured questionnaire was utilized to interview students and parents (n=43) from mixed-status families, who returned from the United States to Hermosillo, Sonora, Mexico since 2010. The participants were interviewed on their experiences with both the American educational system and the Mexican educational system. The collected data was coded using a qualitative coding analysis software named Dedoose guided by a thematic codebook. Data analysis revealed prominent barriers hindering the academic performance of returned students in Mexico such as language struggles, bullying, and teacher insensitivity. Understanding the academic barriers/struggles faced by returned students and identifying the activities, behaviors, and actions taken by students to overcome said barriers can create a guide for more supported journeys of future returned students. The research aims to bring awareness for the returned student population that can lead to systematic and social change in Mexico so returned families can have access to resources and not have to face the struggles that come with return migration, alone.

Cipriano Childers

Biochemistry at University of Arizona

Mentored by Robin Polt, PhD and Nicholas Christie (Chemistry & Biochemistry)

Enhancing Blood-Brain Barrier Penetration of Opioid Peptides via Serine Glycosylation for Improved Pain Therapeutics

This study, conducted in the Polt laboratory, explores the use of serine glycoside modifications to improve delivery of opioid peptides across the blood-brain barrier (BBB). Opioid peptides are promising candidates for pain management due to high potency and reduced risk of addiction compared to conventional opioids; however, clinical application has been limited by poor stability and inadequate BBB permeability. To address these challenges, the lab synthesized a series of glycopeptides featuring serine-linked sugar moieties and evaluated their effects on opioid receptor activity, metabolic stability, and central nervous system (CNS) penetration. Results indicate that addition of serine glycosides significantly enhances peptide stability by increasing resistance to enzymatic degradation in biological environments. This approach enables more efficient CNS delivery and presents a promising strategy for development of pain therapeutics with reduced systemic toxicity and lower potential for abuse. Overall, serine glycosylation provides a rational and innovative chemical modification for improving design of peptide-based drugs targeting chronic pain while minimizing associated risks.

Julio Alejandro Corona

Physics | Astronomy at University of Arizona

Mentored by Rachel Hyneman, PhD and
Hava Schwartz, PhD (Physics)

Determining Mass Dependence of the Large-Radius Jet Identification Algorithm at ATLAS

The Large Hadron Collider (LHC) is a giant physics instrument that collides protons at very high energies and is crucial in studying the fundamental particles of particle physics. In the LHC there is a detector called ATLAS that is used to study these particles. In some collisions at the LHC, the products of collisions produce jets, which are sprays of close-together energetic particles. These jets are often used in the discovery and study of particles. Amongst the triumphs at the LHC was the 2012 discovery of the Higgs Boson, which confirmed the model of how all particles receive mass. To study the Higgs, the ATLAS experiment at the LHC looks at its decay products, specifically the b-quark pair decay. Sometimes, the b-quark pair decay products form two jets which overlap into one large-radius jet. These jets can be hard to distinguish from background top quark production, so ATLAS employs the use of a machine learning (ML) algorithm to distinguish them. I investigated if the ML algorithm had a mass dependence in identifying the look-a-like top quark decay, which is not a desired result as this can bias our understanding of background processes affecting our ability to see the Higgs signal. In future work, the ML algorithm will be retrained in a way to reduce mass dependence.

Katherine Costello

Planetary Geoscience | Mathematics
at University of Arizona

Mentored by Tyler Robinson, PhD (Planetary Sciences)

Assessing Detectability of Biosignatures in the Near-Infrared for NASA's Habitable Worlds Observatory

The next generation NASA Habitable Worlds Observatory (HWO) telescope is currently in the planning phase. One element that needs to be decided is the spectral range HWO will have. Currently, the proposed range is 0.2 to 1.8 micrometers; however, it is uncertain if this range is optimal, as the near infrared (NIR) cutoff of 1.8 micrometers has not been thoroughly investigated to determine the effects of cutoff variance. A more limited range could save time and costs, but an extension could allow for detection of more information. This study explored biosignatures with features in the NIR, namely carbon dioxide and methane, and determined their detectability to inform on an optimal HWO cutoff between 1.6 and 2.2 micrometers. Using *rfast*, designed by Robinson and Salvador (2022), high-fidelity spectra based on Earth's atmosphere during Archean, Proterozoic, and Modern eons were generated, with and without carbon dioxide and methane. These high-fidelity spectra showed methane does not have strong features past the Archean eon, potentially making it a poor candidate to inform on a cutoff. However, carbon dioxide may provide a compelling argument for extending HWO's range, as it has a feature present around 2 micrometers in all three eons. Our next steps are to apply an HWO based instrument noise model to these spectra, then run retrievals on them with *rfast* to determine the detectability of carbon dioxide throughout history and the detectability of methane during the Archean eon.

Fernanda Delgado

Speech, Language, and Hearing Sciences
at University of Arizona

Mentored by Genesis Arizmendi, PhD, CCC-SLP
(Speech, Language, and Hearing Sciences)

Creating Emotionally Protective Experiences for First-Generation Hispanic High School Students Entering Higher Education Environments

Scholars such as Devos et al. (2007) argue that having a strong sense of Hispanic cultural identity correlates to lower perceived academic potential. However, these scholars have not adequately addressed the systemic barriers that play a role in the feelings of imposter syndrome for first generation Hispanic students. The purpose of this study is to evaluate the impact of a culturally responsive campus visit initiative designed to mitigate impostor-related self-doubt and promote belonging among first-generation Hispanic high school students in the Borderlands who are considering attending the University of Arizona. Using a mixed methods approach, I designed a survey with open-ended and Likert-style items to fully understand the participants' perceptions of the culturally responsive campus visit. The participants included 17 high school seniors from the U.S./Mexico Borderlands. Their responses highlighted the significance of the resources provided as well as the positive impact that seeing cultural representation had. These findings suggest that culturally responsive efforts can help address feelings of imposter phenomenon and lack of belonging by connecting students to relevant resources and environments where they feel a sense of safety and comfort. By acknowledging the cultural and environmental mismatches that first generation minority students experience, higher education institutions can implement specific strategies to foster a more inclusive learning environment.

Bryan Anthony Gramajo

Physiology at University of Arizona

Mentored by Daniel Latt, MD, PhD, Francisco Espinoza de los Monteros, PhD, and Christopher Arellano, PhD (Orthopaedic Surgery)

Reimagining Joint Analysis: Evaluating a Markerless Motion Capture System

Accurate measurement of joint angles is critical in physical therapy, but most clinical environments still rely on manual tools, which can lack accuracy; although advanced motion capture systems offer a more precise solution, they are often too costly and complex for routine clinical use. This pilot study evaluates the concurrent validity of Imagine, a markerless, AI-powered motion capture system, against the gold-standard Vicon system, a marker-dependent motion capture system, for measuring ankle dorsiflexion and plantarflexion. Five healthy adult participants completed repeated ankle flexion movements while simultaneously recorded by both systems. Mean peak dorsiflexion and plantarflexion angles were compared using statistical methods to assess agreement and relationship between the two systems. It is expected that the Imagine system will demonstrate comparable results, with minimal differences and strong correlations, supporting its potential as a clinically viable tool for assessing ankle joint range of motion. If validated, the iMagine markerless motion capture system could offer clinicians an accessible, cost-effective alternative with the potential to enhance rehabilitation outcomes and improve quality of life for individuals with mobility impairments.

Edwige Ishimwe

Neuroscience & Cognitive Science | Psychological Science at University of Arizona

Mentored by Vicky Lai, PhD and Lindsay Krebs (Psychology)

Does metaphorical framing of self-concept influence attitudes toward oneself more than literal framing?

Does metaphorical framing influence attitudes towards political and social issues? Previous research has shown that metaphorical framing influences participants' reasoning and guides their decision-making. It also influenced their behavior. In addition, metaphoric framing appears to be more influential than literal language. This study aims to expand on prior research to examine whether metaphorical framing has the potential to influence participants' self-concept, enhance their self-perception, and increase their self-esteem. Our experiment will consist of sixty University of Arizona students. We will ask participants to complete a pre-test using the Rosenberg Self-Esteem Scale (RSE), write about a negative personal experience, read self-concept framing (metaphorical or literal framing of self-concept), and then complete a post-test using the RSE. A t-test will be conducted because we have a within-subject design to compare the means of the samples. Our research design is 1 level (negative) x 2 levels (metaphoric, literal framing). We hypothesize that both metaphorical and literal framings will affect self-esteem. However, participants exposed to metaphoric framing are expected to report a significant difference in self-esteem compared to those exposed to literal framing. These findings may be important for psychological interventions in a therapeutic setting to enhance self-esteem. Metaphor framing can help people contemplate their identity and self-perceptions. Metaphorical language can be a valuable tool in helping individuals reframe their negative self-perceptions and enhance self-esteem. Given that this research is interdisciplinary, it requires further evaluation.

Alani Jordan

Statistics & Data Science | Mathematics
at University of Arizona

Mentored by Doug Haessig, PhD (Mathematics)

THE UNIVERSITY OF ARIZONA

Counting Prime Paths Using the Ihara Zeta Function

The Ihara Zeta Function was developed in the 1960s by mathematician Yasutaka Ihara. Originally, the Ihara Zeta Function was studied on algebraic groups, but mathematicians such as Ki-ichiro Hashimoto began to consider the Ihara Zeta Function within the context of graphs. More specifically, it can be used to count the number of prime paths on a graph, which are closed paths with no backtracking that cannot be represented as some path being repeated multiple times. For multi-cycle graphs, there exists an infinite number of prime paths. However, there is a finite number of paths with a length equal to a specified nonnegative integer, n. Using the Ihara-Bass Theorem and Taylor Series expansion, we can count the exact number of possible paths of length n.

Amanda T. Le

Medicine | Public & Applied Humanities
at University of Arizona

Mentored by John Ruiz, PhD, Francis Morales-Lozada, MBA, MS, Riley M. O'Neill, Daniel A. Hernandez, and Amelia Ibarra-Mevans (Psychology)

Hispanic Health and Cardiovascular Disease: A Systematic Review & Meta-Analysis of the Longitudinal Literature

Cardiovascular disease (CVD) is the leading cause of death worldwide (CDC, 2021). CVD risk varies by several modifiable and non-modifiable factors, including race/ethnicity. Black, Indigenous, and People of Color (BIPOC) are especially vulnerable to poor health outcomes because of elevated risk profiles. However, emerging evidence has demonstrated that U.S.-dwelling Hispanics/Latines tend to exhibit lower all-cause mortality compared to non-Hispanic Whites (NHW). This is an epidemiological phenomenon known as the Hispanic Health Paradox (HHP). Despite robust data documenting a Hispanic health advantage, a mixed consensus remains regarding the underlying mechanisms. Given this framework, do Hispanics/Latines exhibit CVD-specific health advantages (e.g., lower morbidity and mortality)? This systematic review and meta-analysis were conducted in accordance with PRISMA (2020) reporting guidelines. We searched PubMed databases in July 2025 using predetermined search terms and criteria to identify peer-reviewed studies that examined CVD outcomes among Hispanics/Latines. Study characteristics were entered into REDCap. A follow-up meta-analysis synthesized all eligible study effect sizes to evaluate the relationship between Hispanic/Latine ethnicity and CVD. A risk of bias assessment was done for all included studies. We expect the review and meta-analysis will support the HHP by demonstrating significantly lower Hispanic/Latine CVD morbidity and mortality compared to NHW populations. These findings support the HHP by demonstrating a Hispanic health advantage in CVD. Further research should investigate the underlying sociocultural resilience mechanisms that mediate/moderate the HHP and CVD.

Keywords: Cardiovascular Disease; Hispanic Health; Mortality; Morbidity; Review

Michelle Mendivil Cabral

Mechanical Engineering at University of Arizona

Mentored by Stuart A. Craig, PhD and Luke Tronstad
(Aerospace & Mechanical Engineering)

Characterization of Temperature Behavior and Distribution in a Mach 5 Ludwieg Tube

Hypersonic Ludwieg tubes operate by storing pressurized air in the driver tube, which is then released by ruptured double diaphragms or fast-opening valves, creating an expansion wave that travels downstream through the nozzle and into the test section. To maintain a controlled system that replicates real-life flight conditions, heating elements are included to prevent the liquification of the working fluid. While facilities are designed to have known parameters, the design and functions of wind tunnels can affect the initial conditions, posing a major issue in hypersonic and aerodynamic research. Even small discrepancies can lead to flawed outcomes, and within the University of Arizona's Mach 5 Ludwieg Tube (LT5), no previous experiments have been conducted to verify the stability of flow conditions. Consequently, concerns regarding the accuracy of the known parameters have motivated an investigation into the temperature distribution of the flow. By varying the fluid pressure at specific intervals and collecting data from thermocouples placed along different sections of the driver tube, the results will establish actual conditions of the wind tunnel and inform best practices to mitigate potential discrepancies between expected and observed parameters. Further discussion of research practices and limitations will be provided.

Saturn Munstedt

Molecular & Cellular Biology | Gender & Women's Studies at University of Arizona

Mentored by Tally Largent-Milnes, PhD and Nhi Van (Pharmacology)

The Dynamics Between Nitric Oxide, m6A RNA, and Headache

In recent years, n6A-methyladenosine (m6A) RNA – the most common eukaryotic RNA modification – has also become a hot topic of study as it is involved in many diseases, predominantly cancers. Only a handful of studies have investigated the role of m6A RNA and its corresponding demethylases in headache, and mostly in conjunction with opioid use. Separately, nitric oxide (NO) has been shown to inhibit m6A RNA demethylases in vitro1. For decades, researchers studying pain have found that NO causes headache, yet the pathways through which NO triggers headaches are not fully elucidated, nor is the involvement of m6A RNA and its demethylases. This project aims to study the interaction of these molecular players in relation to headache and headache treatments. Here, we use a medication overuse headache (MOH) model that employs sumatriptan for induction and maintenance. In doing so, this project will further our understanding of the mechanism behind headaches, as well as provide a link between epigenetics and pain.

Alexis Anahi Nevarez

Psychology | Political Science | Criminal Justice
at University of Arizona

Mentored by Frank Gonzalez, PhD
(Government and Public Policy)

The Impact of Empathy-Based Immigration Appeals on Political Efficacy and Support for Undemocratic Actions

This paper examines whether empathy-based immigration appeals impact trust in the government and the willingness to subvert legal ordinances and democratic norms to effect change. Using a 4-condition experiment, participants (n = 703) were randomly assigned to one of four conditions: the control video condition, the mild video condition, the extreme video condition, or the extreme text condition. Thereafter, participants answered Likert-style questions about their attitudes towards immigration. The goal of the study was to discover if exposing the public to disturbing imagery and text about family separations at the US-Mexico Border, during the Trump Zero Tolerance Policy, would impact participants' efficacy and willingness to subvert democratic norms to help refugees. The findings revealed that the disturbing video and text conditions led to a decrease in external efficacy among Democrats. The mild condition and disturbing text condition lead to an increased willingness to support undemocratic actions to effect change among democratic participants. The results showed that external efficacy mediated the effect of empathy appeals on support for undemocratic actions. The results indicate that empathy appeals lead to lower levels of external efficacy, which in turn makes participants more willing to support undemocratic actions. The study helps to understand the constraints of the benefits of empathy appeals, and it will contribute to the existing literature on American public opinion regarding immigration.

Dorian Noriega

Mechanical Engineering at University of Arizona

Mentored by Andrew J. Fuglevand, PhD and
Jehad Abdullah Alfaleh (Physiology)

Evaluating Non-Invasive Methods to Control a Robotic Arm for High-Level Tetraplegics

Patients suffering from tetraplegia face numerous challenges performing everyday tasks like feeding themselves, opening doors, dressing themselves, or maintaining personal hygiene. Robotic arms can be mounted on wheelchairs and controlled by joysticks to help tetraplegics grab and lift objects, but for patients suffering from high level tetraplegia an alternative control method is necessary to use the robotic arm. Recent advances in technology like brain machine interfaces (BMIs) have demonstrated potential in restoring control over robotic arms by implanting chips in patients' brains that analyze neural activity and transmit code that is translated into specific movements of the arm. However, BMIs require invasive brain surgery, are expensive, and lose functionality within a few years. This study evaluated non-invasive methods of control, like head movement and voice command sensors, by analyzing how patients improved their control of a robotic arm using these control methods over multiple practice sessions. We assessed if these non-invasive sensors are a viable alternative to BMIs by 1) having subjects perform 8 specific tasks from the Action Reach Arm Test (ARAT) and assessed if their ARAT scores and time to complete the tasks improved over 5 practice sessions and 2) compared this data to published results assessing how patients improved their control of a robotic arm to complete ARAT tasks using a BMI. This research will determine if non-invasive methods of control are a viable alternative to BMIs, potentially giving tetraplegics a more accessible option to control assistive devices to regain their independence.

Alicia Salazar Contreras

Speech, Language, and Hearing Sciences | Spanish: Generalist emphasis at University of Arizona

Mentored by Meghan Darling-White, PhD, CCC-SLP and Trianna Oglivie (Speech, Language, and Hearing Sciences)

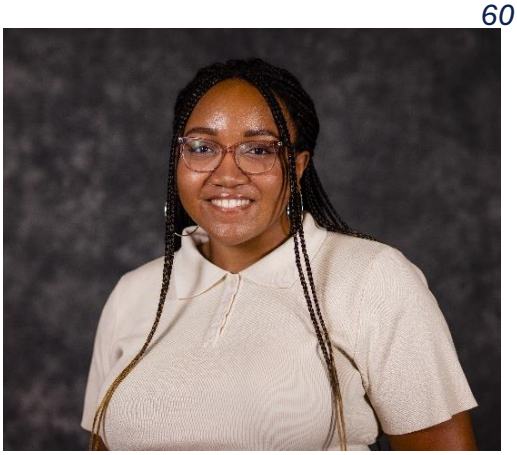
"Sopa de Pescado": Spanish Language Passage Development for the Differential Diagnosis of Motor Speech Disorders

There is a large gap in motor speech research involving individuals who speak languages other than mainstream American English. As a result, resources for the differential diagnosis of motor speech disorders in Spanish speakers are few to none. In efforts to better represent the Spanish speaking population in both research and clinical speech-language pathology settings, this study aimed to develop and validate a Spanish language reading passage. This passage was specifically created for the differential diagnosis of motor speech disorders in Spanish speakers. Patel et al. (2013) established a framework for the development of reading passages that contain various attributes and characteristics used for the differential diagnosis of motor speech disorders. Using this framework, we developed "Sopa de Pescado." This passage included characteristics like words of varying length, repeating words, a full phonemic repertoire, and more. Sixty-five native Spanish speakers participated in an online survey to provide feedback on grammar and word order and feedback consisted of grammatical corrections, stylistic preferences, and punctuation, which was implemented when appropriate across several passage iterations. Through the successful creation and finalization of "Sopa de Pescado", the ability to successfully create accurate and reliable tools for the differential diagnosis of motor speech disorders in languages other than mainstream American English. This is achievable through the adoption of the framework established in "The Caterpillar" passage and can be used to develop more tools for the differential diagnosis of motor speech disorders, closing the gap in resource availability for underrepresented populations.

Gianna Wynn

Psychological Science at University of Arizona

Mentored by Nell Maltman, PhD
(Speech, Language, and Hearing Sciences)



Evaluating self-report and direct assessment of cognitive-linguistic abilities among female Premutation carriers

The *FMR1* permutation (PM) is a genetic mutation on the X chromosome that can cause differences in cognitive and linguistic abilities. These abilities can be assessed using self-report and direct assessments. Prior work shows that pragmatic communication and working memory differ in this population, and it's important to evaluate consistency between assessment types for research and clinical purposes. Anxiety may influence how participants perform in these domains and is present at higher rates in females with PM. The present study asked two primary questions: Are there consistencies between self-report and direct assessments in communication and cognition? Does anxiety play a role in communication and cognitive assessment performance? The present study utilized collected data from a larger study (PI: Maltman). Measures included the Pragmatic Rating Scale, La Trobe Communication Questionnaire, Behavior Rating Inventory of Executive Functioning-Adult Version, Digit Span Task, and the State-Trait Anxiety Inventory. Participants included 32 females with PM and 24 controls (ages 30-60). Analyses included ANCOVAs and Pearson partial correlations, controlling for education. No differences were observed in pragmatics across contexts. For working memory, both groups performed consistently for direct assessments but not self-report, suggesting an interaction between group and assessment type. In the PM group only, but not controls, were associated with all assessments, with the exception of pragmatic direct assessment. Together, findings suggest that assessment type and anxiety type may shape performance on working memory measures in the *FMR1* PM, with important implications for continued research and clinical practice.

Summer Research Institute (SRI)

Program Coordinator: Karla Smith, MPA
Instructor: Karla Smith, MPA
Graduate Teaching Assistants: Carolyn Tureaud, ABD
Sponsor: University of Arizona Graduate College

Franklin Acosta

Music Performance at East Tennessee State University

Mentored by Jackie Glazier, PhD (Fine Arts)

A Clarinetists Guide to Stylistic Authenticity in Klezmer Music: An Exploration of Recordings of Paul Schoenfeld's Klezmer Sonatina

Klezmer is a traditional style of Jewish folk music that originated in Eastern Europe and was brought to the United States by Jewish emigrants between 1880 and 1924. While it is usually performed at weddings and communal events, there has been an influx of musicians wanting to learn this music for non-religious settings. Typically, klezmer is passed down mainly through rote learning, which is historically taught by a teacher. Recently, interest in klezmer has grown among performers outside the Jewish community, raising questions about authenticity, interpretation, and cultural ownership. How can a clarinetist approach this style respectfully while not being a part of this culture? This paper explores the challenges faced by classically trained clarinetists who are not part of the Jewish culture but still want to learn and perform klezmer music. This paper will examine eight professional recordings of Paul Schoenfeld's Klezmer Sonatina in order to reflect on stylistic variations and challenges with approaching Klezmer music. This research combines performance and ethnomusicological reflection, focusing on insider and outsider perspectives in learning klezmer. Though performance and score study can offer valuable insights, they still lack the knowledge of the lived culture. This project highlights the difficulties outsiders may face when engaging with klezmer and examines how a non-Jewish classical clarinetist can approach the style respectfully through discussion and reflection.

Keywords: ethnomusicology, klezmer, clarinet

Razak Adamu

Aerospace Engineering at University of Arizona

Mentored by Jekan Thanga, PhD
(Aerospace & Mechanical Engineering)

Verification of CubeSat Attitude Estimation Using Deep Learning Methods

AS the cost of placing satellites into orbit has decreased, the number of small-form-factor CubeSats and SmallSats in low Earth orbit (LEO) has significantly increased, driving the need for reliable and cost-effective inter-satellite attitude determination for coordinated operations. One proposed solution uses low-power LEDs of varying wavelengths and commercial cameras, with a dual-neural-network system that extracts 3D position from 2D images to determine relative attitude. The second neural network in the system estimates the satellite's rotation and position, but has previously misclassified LEDs and mistaken noise for signals due to insufficient photorealistic training data. This study utilizes the image rendering tool Blender 4.5 to generate a more realistic synthetic dataset for improving model performance. A total of 10,000 images were created in a simulated Low Earth Orbit (LEO) environment that included the Sun, Earth, and a 24U CubeSat. The camera-to-CubeSat distance was varied within a 1.8-2 meter range. Image generation was automated using a Python script within Blender. The neural network developed by Raj et al. (2024) was evaluated using this dataset. The generated imagery provided a promising data set that more accurately models lighting for the desired orbital situations. Further research should be conducted using the imagery developed in this project to train a new neural network and test it using the experimental test setup proposed by Raj et al., (2024).

Jacob Agcaoili

Aerospace Engineering at University of Arizona

Mentored by Olesya Zhupanska, PhD and Daniel Diaz, PhD (Aerospace & Mechanical Engineering)

Evaluation of Carbon Fiber Reinforced Polymers with Optical Emission Spectroscopy

In the aerospace industry, the use of plasma has become a popular method in the development of materials. This study aimed to assess the damage done to carbon fiber reinforced polymers (CFRPs) when subjected to inductively coupled plasma (ICP). Two analyses were done on the composites to determine what happens during and after the damaging process. One analysis used optical emission spectroscopy to determine what elements are detected when the composite is subjected to the ICP, and the second analysis were photos taken under a digital microscope to determine the damage to the laminate. Results found that the emissions detected during the plasma test were primarily sodium with none of the expected carbon emissions. Additionally, tests found that 5-harness satin laminates will delaminate during thermal decomposition, with the epoxy matrix undergoing pyrolysis and leaving exposed carbon fibers. The results found that the limiting factor for CFRPs are the epoxy matrix and that refractory materials should be developed so the whole structure does not fail under extreme temperature environments. Additionally, more sophisticated configurations for plasma testing materials with ICP can be developed and prove to be a practical choice for testing solid materials with directed energy.

Randall Candaso

Information Science: Data Science emphasis
at University of Arizona

Mentored by Greg Chism, PhD (Information Science)

Using Machine Learning to Project End of Career Athlete Trajectory: What Defines Immortal Legacy?

Previous research has applied different machine learning algorithms to help analyze Hall of Fame voting patterns in professional baseball, often with the goal of identifying which statistics voters have prioritized in the past. However, few studies have translated this analysis into developing further predictive tools for evaluating current player performance. This study aims to create a predictive modeling pipeline that not only understands the statistical values of induction, but utilizes that understanding to predict which currently active Major League Baseball players are on a Hall of Fame trajectory. The data collected for this research included the hitting and baserunning statistics of over 300 historical and 250 active MLB players. The pipeline incorporates a variety of modeling techniques including soft clustering to identify patterns in seasonal performance, L1-regularization for feature selection, XGBoost regression to estimate remaining career production, and Random Forest classification to predict Hall of Fame status. After extensive processing and modeling, the pipeline concluded that out of the currently active player pool, 23 modern players were identified to be on the path to Hall of Fame induction. The objective of this modeling pipeline is to demonstrate and support the usage of machine learning techniques in the decision-making process of evaluating long-term outcomes in the sporting world.

Nate Olea Chavez

Political Science: Law and Public Policy emphasis | Law at University of Arizona

Mentored by David Clark, PhD (Philosophy)

Bridging the Gap Between Moral and Economic Disagreements of Rationalization: A Computational Methodology in Contract Jurisprudence

Contract Jurisprudence has been dominated by two schools of thought: the moral and economic interpretation of the law. Both of these schools of thought come from different disciplines with separate intentions in mind. However, one aspect that has been consistent amongst both of these sides of the spectrum is the methodology used for their claims and theories reside in philosophical methodology and non-computational thematic analyses. While scholars in this field struggle to implement theories that encapsulate the vast nature of contract law for rationalization, they do not rely on a computational text analysis perspective. In this paper, a semi-supervised topic modeling approach was used to analyze a corpus of 500 contract case texts from SCOTUS. To test the significance of these jurisprudence theories in court decision making, seed words from both moral and economic theories were used. While some findings indicate there were some instances that appeared to show that case texts had a large presence of moral or economic words/phrases belonging to their respective theory, results are inconclusive. There were unrelated residual topics and most cases didn't find a significant presence of listed theories, possibly due to an exclusive list of seed words thought to constitute theories. Additionally, a larger corpus may be a better approach in text mining for philosophical interpretations of this nature. As this paper served the purpose of providing a proof of concept, additional research efforts may benefit from a more accurate computational approach and better seed words.

Mikala Chee

Psychology at Fort Lewis College

Mentored by Christina Andrews, JD, MPH, MBA, MA (Medicine)

Two Worlds: The Importance of Ethnic Identity in Higher Education Pursuance Among Native Youth

Indigenous people continue to face the issues derived from historical and generational oppression and culture insensitivity in modern practices (e.g., psychological sciences, education, law and policy). Ecological models have effectively described the transgenerational influence on individuals, family, community, and culture. Modeling the Wassaja Carlos Montezuma Center for Native American Health at the University of Arizona, the four (4) quadrants represent Indigenous-led initiatives in social justice, health, wellness, research, law and policy and workforce development to advance Indigenous well-being practices and to increase Native professionals through pathways with Native youth. Self-report and behavioral measures of 27 Native adolescents, from ages 14 to 18, were taken during the American Indians into Health Profession (AIHP), week-long Summer Program to analyze educational barriers, by understanding the integration of an ecological model. After the week-long observations and interactions with the adolescents using a Native American lens, a prudent analysis was made. There were two (2) recurrent themes that emerged, one of exploration of their culture identity and another of a sense of belonging in their environment. Addressing the systemic barriers Native youth face when exploring college programs related to health will be explored throughout the thematic review. The objective of this research is to acknowledge historical trauma to create culturally appropriate solutions and interventions in the education system for Native youth.

Jasmine Garnett

Aerospace Engineering at University of Arizona

Mentored by Stuart A. Craig, PhD, Adam Skora, Luke Tronstad, and Gray Hardy
(Aerospace & Mechanical Engineering)

Wave Propagation Analysis to Characterize Wave Speed in Boundary-Layer Instabilities

Investigating the creation of boundary-layer instabilities is essential to determine the stability of the flow over an object and how it will affect the flight conditions of various aerospace components. This study examines how wave speed is determined by investigating how sound waves propagate at different frequencies. Waves were propagated at different frequencies through an aluminum tube and tracked with pressure sensors.LabVIEW was used to collect the data at each frequency where it was then transferred to MATLAB for data processing using different power spectrum microscopy commands. Wave speed was then calculated at each frequency to determine if the experimental setup is correct and if the experimental method can be applied to a Mach 5 Ludwieg Tube wind tunnel and dealiasing signals. Findings suggest that the experimental set-up is incorrect due to the wave speeds calculated not matching the desired outcomes, indicating that a change must occur. With the creation of instabilities, it results in the transition from laminar to turbulent flow which would create higher values of skin friction drag over an object within a wind tunnel and, therefore, aircrafts in freestream velocity. With this knowledge, it allows for further investigation into how high wave speeds will affect the boundary-layer of aerospace models within the test section of a Mach 5 Ludwieg Tube wind tunnel to understand how high speed waves will affect real-life aircrafts.

Keywords: Boundary-layer, instabilities, MATLAB, LabVIEW, wave propagation, transition, wind tunnel, laminar, turbulent

Shea Hollis

Molecular & Cellular Biology at University of Arizona

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

The Hidden Switches of Segmentation: Discovering even-skipped Enhancers

The evolution of segmentation remains a mystery. Arthropods, annelids, and chordates all have segmented body plans, however, their closest sister groups do not. Did they have a common ancestor, or did segmentation evolve multiple times? Segmentation mechanisms differ between organisms, even within a phylum, such as the two arthropods, *Drosophila melanogaster* and *Tribolium castaneum*. *Drosophila* segments simultaneously. *Tribolium* and most other segmented animals segment sequentially from the posterior. Despite these differences, both pattern their segments with pair-rule genes, like *even-skipped (eve)*, expressed with two-segment periodicity. In *Drosophila*, the simultaneous production of eve stripes is regulated by stripe-specific enhancers. Nothing is known about *Tribolium*'s *eve* enhancers. However, given that *Tribolium eve* stripes appear sequentially in an oscillating manner, we hypothesize that *Tribolium* has enhancers that drive cycling expression in the posterior and stripe-specific expression. We identified potential enhancer regions using bioinformatic tools and published ATAC-Seq data, including a 3.6 kb region downstream of the transcription start site. This region drives expression that overlaps with *eve* expression in early stripes two and three, indicating a possible stripe enhancer. The 3.6 region, along with two other identified enhancers, drives expression in an early posterior gradient, suggesting multiple shadow enhancers regulate the posterior oscillator. There is also a late expression associated with hindgut development. We designed and cloned gRNAs to use CRISPR to knockout specific sections of the 3.6 region. Exploring enhancers involved in *Tribolium* segmentation can help understand the evolution of *eve* and how the regulatory network controlling segmentation evolved.

Keywords: Tribolium, segmentation, even-skipped, enhancer, 3.6 kb region

George Hyland

Agribusiness Economics at University of Arizona

Mentored by Anna Josephson, PhD and
Jeffrey Michler (Applied Economics)

Understanding the Effect of the Gender of Farm Plot Managers on Measures of Food Security for Smallholder Households in Malawi

This study analyses the impact of female farm plot managers on food security metrics for smallholder households in Malawi. Men and women exhibit distinct cropping patterns and access to farming resources, and this study hypothesizes women's cropping patterns improve food security metrics by ensuring a more stable and diverse diet for household members. Survey data is provided by the Malawi Integrated Household Panel Survey (IHPS) collected by the National Statistical Office in conjunction with the World Bank Living Standards Measurement Survey – Integrated Household Surveys on Agriculture (LSMS-ISA). The dataset contains information on household agricultural production, income, and consumption over the years 2013, 2016, and 2019. Over the three years, a total of 7,676 households met the criteria of engaging in smallholder farming and reporting their food consumption over a seven-day period. Initial analysis reveals that households reported an average Food Consumption Score (FCS) of Acceptable (83.1%) Borderline (14.88%) and Poor (2.03%) over the three years. Linear regression analysis will be used to estimate the impact of the gender of farm plot managers on the FCS. Additional linear regression and ANOVA tests will be used to determine if households with female plot managers are able to better cope with income and yield shocks. This study adds to the existing work on food security in Malawi and Sub-Saharan Africa by directly investigating the link between gender dynamics in smallholder households and metrics of food security.

Ntsumi Machiana

Chemistry at Pima Community College

Mentored by Jeanne Pemberton, PhD
(Chemistry & Biochemistry)

Exploring the Synthesis and Properties of Glyonic Liquids

Ionic liquids (ILs) are salts (substances made of two oppositely charged molecules) that remain liquid below 100 °C and are valued for their tunable properties and use in environmentally friendly applications. When ILs are combined with biological components, such as Pseudomonas aeruginosa, they can form glyonic liquids (GLs), a new subclass of materials that may be more sustainable and less toxic. This project focuses on synthesizing a lysine-based GL and exploring its physical and chemical properties. One of the primary objectives is to evaluate its potential as a green solvent in environmentally friendly chemical processes. To study the GL, several characterization methods were used. Density measurements were conducted at various temperatures (20-90°C) to gain a deeper understanding of how the material behaves under changing conditions. Karl Fischer titration was used to determine water content, and purification steps, including pH adjustment and liquid-liquid extraction, helped isolate the GL from byproducts. Although full results are still being collected, this project provides early insight into the behavior and stability of lysine-based GLs. The synthesis process was successful, and initial tests show promise for continued exploration. Future work will involve running more replicates of density measurements to confirm trends and measuring the properties of other GLs to compare their performance. These steps will help determine whether lysine-based GLs could be used more widely for CO_2 capture or other sustainable chemical processes.

Grace Mazurik

Psychological Science at University of Arizona

Mentored by Stephen Cowen, PhD and
Russell Dougherty (Psychology)

Time interval estimation in the TgF344-AD rat model of Alzheimer's disease

Alzheimer’s disease (AD) is the most common neurodegenerative disease in older adults, and is primarily characterized by reduced cognitive function, including an impaired ability to track the passage of time. Several studies have shown a diminished interval timing ability in AD patients; however, few investigate the cognitive processes and neural mechanisms that underlie time perception deficits in AD. Additionally, no studies to date have examined time perception in animal models of AD. Here we use TgF344-AD rats, a transgenic rodent model of AD that recapitulates pathological hallmarks of the disease, to investigate differences in time estimation compared to wild-type (WT) controls. We hypothesized that AD animals would show greater error and variance in interval estimations than their WT counterparts. 12 Fisher 344 rats, (n = 6 WT, n = 6 AD) were trained in a novel treadmill time estimation task in which rats learned to make a nose-poke response to terminate involuntary treadmill running after intervals of 5, 7.5 and 10 seconds. Early nose-poke responses were penalized by increased treadmill speed and additional running time. Preliminary analyses found no significant differences in interval estimation error or variance between AD and WT groups; however, these findings are limited by the very small sample size. To provide validity in study findings, a larger dataset is required to execute analyses of behavior and detect group differences. To advance the understanding of time perception in AD, future research will incorporate in-vivo electrophysiological recordings to examine neural mechanistic differences between transgenic rodents and their controls.

Natalia Morales

Mexican American Studies | Gender & Women's Studies at University of Arizona

Mentored by Anna Ochoa O'Leary, PhD and Rosa Maldonado (Mexican American Studies)

How Student Centered Learning Can Be Used to Support Hispanic/Latinx Students and Instructors in Higher Education

Studies in higher education pedagogy have shown that student-centered learning (SCL) models support student success by increasing student investment in their own learning, while also showing that culturally responsive teaching and having representation in the classroom do the same. This study examines the effectiveness of SCL as a culturally responsive pedagogy in higher education with a focus on supporting Hispanic/Latinx students at Hispanic Serving Institutions (HSIs). This study is a self-study, conducted by instructors of an intro-level Mexican American Studies course at an HSI, using 47 reflection papers written by students at the end of the course. These papers are first coded blindly using a code book and then discussed for consistency and further development of the book. Results will be analyzed using a mixed methods approach, including examining code counts and co-occurrences, along with interpretations of writing excerpts and thematic analysis. Early results show a strong identification with course content from Hispanic/Latinx students, that students consistently point out gaps in their previous knowledge and show the desire to continue filling these gaps, along with a strong critical engagement with the material from many students. These findings add to the growing body of literature that shows that SCL is an effective teaching strategy to increase student success and engagement, while specifically showing how it can be used to support minority student success in higher education. This study also offers a model for how reflective practices can be used by educators as they integrate SCL in their courses.

Samantha Morvant

Psychology | Anthropology at University of Arizona

Mentored by Gloria D. Coronado, PhD and
Josheili Llavona (Cancer Center)

Understanding the impact of the COVID-19 pandemic on breast cancer screening rates at Federally Qualified Health Clinics in California

Background: When the COVID-19 pandemic swept the nation, routine cancer screenings began to significantly decline. Underserved communities such as racial and ethnic minorities, individuals with low income, and those without insurance displayed heightened breast cancer screening rate disparities, which the pandemic exacerbated. Federally Qualified Health Clinics (FQHC) aim to serve and mitigate these screening disparities.

Methods: We utilized a convergent-mixed methods approach assessing both quantitative and qualitative impacts of the pandemic on FQHCs in Los Angeles and Orange County. The quantitative data were gathered from the Human Resources and Services Administration (HRSA) for 2020 to 2023. The qualitative data were gathered from 20 patient interviews from FQHCs.

Results: Between 2020 and 2023, breast cancer screening rates at the FQHC site-specific system improved from 32.56% to 63.59%, surpassing the statewide FQHC coverage of 54.94% by 2023. Although both the statewide and site-specific rates remain below the Healthy People 2030 goal of 80.3%, the site demonstrated steep progress in expanding screening coverage across its clinics. Interviews revealed mixed experiences. Although some patients reported difficulty, many patients did not recognize a change or challenge in obtaining a breast cancer screening appointment.

Conclusion/Implications: This study highlights screening trends and experiences at FQHCs to better understand COVID-19's impact and inform future interventions. This displays the importance of strengthening the FQHC systems to promote better recovery efforts in underserved populations in the event of future healthcare disruptions.

Daniel A. Musquiz

Chemical Engineering at University of Arizona

Mentored by Paul Blowers, PhD
(Chemical and Environmental Engineering)

Prediction of Heat Capacity of a Prototypical Medium-Chain Chlorinated Paraffin Using Quantum Chemistry: C14Cl6H24

Medium-chain chlorinated paraffins (MCCPs) are widely used in industrial chemicals that have emerged as persistent environmental contaminants. However, fundamental thermodynamic data for these compounds remain limited. In this study, density functional theory (DFT) calculations at the B3LYP/6-31g* level were used to predict gas-phase heat capacities for the representative medium-chain chlorinated paraffin (MCCP) congener 1,7,7,8,8,14-Hexachlorotetradecane across a temperature range of 200-1500 K. Boltzmann-weighted populations of each conformer were calculated to obtain ensemble-averaged isobaric heat capacities. Hindered corrections were applied to low-frequency torsional modes and harmonic vibrational frequencies were scaled for improved accuracy. We find close agreement between our DFT-calculated heat capacities and experimental data for lower carbon-chain chloroalkanes and octane, supporting the accuracy of predictions for 1,7,7,8,8,14-Hexachlorotetradecane, which lacks direct measurements. This work addresses a critical data gap in MCCP thermodynamics, supporting more accurate modeling of their atmospheric behavior and environmental persistence.

Elias Post

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

Mentored by Martha P.L. Whitaker, PhD and
Neha Gupta (Hydrology & Atmospheric Sciences)

Rainfall and Runoff in the Bronx Wash

Urban flash floods from excessive runoff pose serious risks to human health and property. This study investigated the mathematical relationship between rainfall and runoff in the Bronx wash over the past three years by calculating runoff ratios—the proportion of rainfall that flows off the land surface rather than infiltrating soil, evaporating, or being stored. Runoff ratios measure how efficiently a watershed sheds water during rain events, ranging from 0 to 1, with higher values indicating greater flood risk. Urban runoff ratios are typically elevated due to impervious surfaces like concrete and asphalt that prevent infiltration. However, semi-arid watersheds like those in Tucson tend to exhibit lower ratios due to higher evapotranspiration rates and spatially variable rainfall patterns.We used high-resolution water level and precipitation data from the Pima County Regional Flood Control District (PCRFCD), supplemented with lower-resolution precipitation data from a nearby National Centers for Environmental Information gauge for three events. Water level data were converted to flow rates using Manning's Equation. We calculated runoff ratios from 29 flow and precipitation event pairs. Ratios ranged from 0.04 to 0.59, averaging 0.19 and showed no clear pattern. This wide range reflects the flashiness and uncertainty of flow events in semi-arid urban areas. The lack of clear pattern likely results from data noise and processing errors. These findings can help PCRFCD plan flood mitigation strategies such as green infrastructure. Additional data or more sophisticated analysis methods are needed to better define the precipitation-runoff relationship in the Bronx wash.

Harmony Switzer-Tryon

Psychology at
California State Polytechnic University, Humboldt

Mentored by John Ruiz, PhD and
Ashley Huggins, PhD (Psychology)

Examining the Relationship Between Childhood Trauma and Executive Functioning

Background/Objectives: Prior research examining childhood trauma and executive functioning, which includes abilities such as self control, problem solving, and adapting to change, has yielded mixed results. Some studies suggest trauma exposure and severity are linked to executive functioning deficits, potentially varying by trauma type, while other studies report no significant associations. This study aimed to further clarify this relationship by investigating whether childhood trauma severity is associated with executive functioning deficits in healthy adults, hypothesizing that greater trauma severity would predict poorer performance. Methods: Forty-eight healthy adults were drawn from a larger parent study. Childhood trauma severity was measured using the Childhood Trauma Questionnaire (CTQ), a validated retrospective self-report tool. Executive functioning was assessed using two neuropsychological tests: the Trail Making Test (TMT), measuring cognitive flexibility, and the Color Word Interference Test (CWIT), assessing inhibition and cognitive flexibility. Results: Contrary to our hypothesis, childhood trauma severity did not significantly predict executive functioning performance on either the TMT or CWIT. All regression models yielded non-significant results. Conclusion: In this sample of healthy adults, childhood trauma severity was not associated with executive functioning. These null findings contribute to the mixed literature but should be interpreted cautiously. The small sample size and limited trauma variability may have reduced statistical power to detect subtle effects. Additionally, executive function measures used may lack sensitivity to detect minor executive functioning disruptions in non-clinical populations. Future research should examine more diverse samples, including individuals with greater trauma exposure, and consider alternative or more sensitive cognitive measures.

Gisela Uribe

Data Analytics | Sociology at Beloit College

Mentored by Sheila Soto, DrPH, MPH (Public Health)

A Preliminary Analysis on Latine Parental Awareness and Attitudes Toward HPV Vaccination in Arizona Border Counties

Researchers have shown that, of any U.S. racial and ethnic group, the Latine community has the lowest utilization of preventative care. Existing literature supports that the Human Papillomavirus (HPV) disproportionately affects ethnic and racial minorities underscoring the impact that health providers' vaccine recommendation, culturally competent preventative care, and a patient's social determinants of health have on vaccine uptake. This preliminary study aimed to gain a better understanding of Latine parental attitudes towards HPV and how their attitudes impact vaccine uptake among their youth in U.S-Mexico border counties; Santa Cruz and Cochise, AZ. The preliminary findings and discussion in this study were supported by the AZ-VIVIR study; a CDC sponsored, and IRB approved community-based research study. Participants were recruited by two Federally Qualified Health Centers (FQHC) to participate in a community listening session (CLS) facilitated by the research staff. The CLS engaged participants in discussions using structured questions to learn parents' awareness, practices and attitudes towards the HPV vaccine for their youth. The deliverable for this paper is a preliminary codebook and themes that will guide the thematic analysis for the remainder of the study. Four CLS were transcribed and themes including limited disease and vaccine educational material, healthcare providers' role for vaccine recommendations, social and community context, and misconceptions on the HPV transmission were observed. Implications for future research can propose a multi-level intervention to enhance vaccine communication through an innovative dental based project to improve preventative care measures, for the Latine community.

Keywords: U.S-Mexico border community health, Latine preventative care, community-based research, HPV, vaccine equity, multi-level intervention

Guadalupe Villegas

English: Literature emphasis
at California State University, Dominguez Hills

Mentored by Jennifer Jenkins, PhD (English)

La Santa de Cabora: How Catholicism and Curanderismo affect the perceptions and treatment of women in The Hummingbird's Daughter by Luis Alberto Urrea

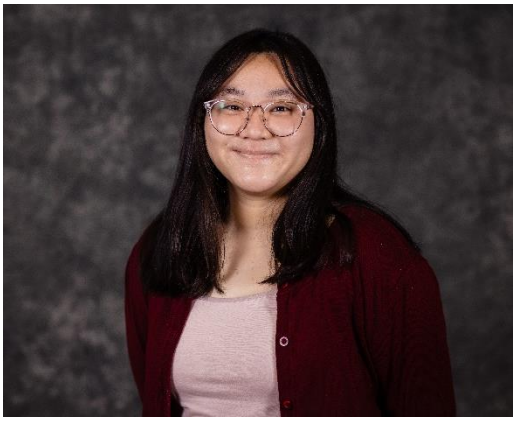
Scholars have examined the novel, *The Hummingbird's Daughter* by Luis Alberto Urrea (2005) only through the religious or the transnational aspects regarding the treatment of women throughout the novel. This research analyzes Catholicism and curanderismo in the novel *The Hummingbird's Daughter* and their effects on how women are treated and perceived in the novel. I argue that the influences of the Catholic church, especially their opinions towards the Indigenous healing practice of curanderismo, tip the scales in how women are treated if they do not conform to the accepted teachings of the Catholic church. This literary analysis of *The Hummingbird's Daughter* highlights the patriarchal mindset of Catholicism that serves as a basis for the critiques that women receive throughout their lifetime. Moreover, this foundation provides a solid interrelationship between the Catholic church and government that is fleshed out in the novel. The novel depicts the complicated relationship between religion and identity, specifically with Teresa Urrea herself. The relationship becomes intricate due to Indigenous traditions and practices that are often villainized by the government and Catholic church. *The Hummingbird's Daughter* also portrays a hero's journey through the exile of Teresa; however, I argue that her journey was never completed due to her inability to find peace with her identity based on these effects from the Catholic Church.

Keywords: Teresa Urrea, Curanderismo, Catholicism, Identity, Women

Emily Vo

Computer Science at Cornell University

Mentored by Bryan Carter, PhD
(Africana Studies and Humanities)



Human-Robot Interaction, Public History, and the Museum: A Case Study of Using tēmi in the African American Museum of Southern Arizona (AAMSAz)

Due to rising trends of artificial intelligence (AI), the need to evaluate the effects of technologies, such as robotics, require interdisciplinary approaches to Human-Robot Interaction (HRI) studies. With particular focus on the education and public history domain, the development of robots as museum tour guides have gained considerable merit and attention within HRI. Thus, the need to evaluate HRI in the museum setting is crucial to understanding the ways in which changing attitudes of visitors and museum staff have responded to rising technology and robotic applications. By conducting a case study of the temi robot in the African American Museum of Southern Arizona, this paper aims to approach HRI within a critical digital humanities and grounded theory framework. The visitor experience is evaluated through end-of-tour surveys while museum staff perspectives are examined in one-on-one qualitative interviews. Though the survey and interviews have yielded solely preliminary results, the perspectives of museum staff are thematically categorized into generally positive outlooks toward their integration of robotic applications. The interviews reveal core themes, namely enhancing or engaging the museum's work with certain demographic groups and viewing temi as an add-on to their already existing museum responsibilities. This study highlights the importance of including both visitor and museum staff perspectives within HRI and how AI technologies are being adapted specifically within African American history museums.

Keywords: human-robot interaction, museum, public history, critical digital humanities, temi robot, social robot

Lauren Whitaker

Physics at University of Arizona

Mentored by John Schaibley, PhD and
Garett Reichenbach (Physics)

Layer-dependent Photoluminescence in InSe

In 2004, the first 2-dimensional material (Graphene) was made via the well-known mechanical exfoliation technique. The exfoliation of bulk material into atomically thin layers allowed for the observation of certain quantum phenomena as the properties of the 2D material changed from that of the bulk material. InSe, a 2-dimensional semiconductor has been shown to have a layer-dependent band gap. We conduct low temperature photoluminescence experiments on thin InSe to replicate previous results from literature. To do this, we optically identified thin flakes of exfoliated InSe and used atomic force microscopy (AFM) to determine the cleanliness and surface roughness of the material. AFM uses a small, sharp tip attached to a cantilever to characterize the surface roughness of a material. A laser beam and photodetector are used to detect nanoscale movements across the surface of the material, allowing the AFM to record the height of the material. This allowed us to see any dirt on the surface and know the thickness of the material. We then used photoluminescence to look at the band gap of InSe. A 532 nm laser was directed at the InSe, exciting the electrons in the material, and causing them to emit light at certain energies. These energies correspond to the wavelength of light being emitted from the material. Our measurements show that thinner 2D InSe emits light at higher energies while thicker 2D InSe emits light at energies about 0.05 eV lower. These energies correspond with a changing band gap in InSe, supporting the literature data.

UROC-Prep

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Ruben Peña

Biosystems Engineering at University of Arizona

Mentored by Alexander Bucksch, PhD and
Suxing Lui (Plant Science)

THE UNIVERSITY OF ARIZONA

Development of Sorghum roots under drought stress: An analysis of DIRT/3D pipeline for 3D root phenotyping

Root architectural phenotype forms in response to a plant's environment. Understanding the diversity of root architectural phenotypes in a field is crucial to understanding how plants respond to environmental stressors caused for example, by extreme weather events such as the current decadal mega drought in the southwest of the United States. Root architectural phenotypes encode optimal soil resource acquisition strategies. Sorghum (Sorghum bicolor *(L.) Moench)* is an important bioenergy crop that exhibits remarkable heat and drought tolerance. Phenotyping of sorghum roots can reveal the characteristic traits associated with biomass accumulation under drought conditions. Here, we study the architectural development of the sorghum roots in drought and non-limiting conditions with 3D imaging using the DIRT/3D pipeline. Sorghum was planted in six blocks with alternating drought and non-limiting treatments. We harvested three genotypes selected for their contrasting development weekly to collect root architecture traits such as root angle, root system width, and above-ground traits such including dry weight. We first validated the new sorghum trait extraction pipeline against manual measurements and analyzed the time series for characteristics that identify high-performing genotypes. Our research will support efforts to understand drought tolerance in plants and help plant breeders to understand the genetic make-up to reduce unsustainable fertilizer input in agricultural production.

Victor Vigbedorh

Molecular & Cellular Biology at University of Arizona

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

Eve Enhancers Can Elucidate Mechanisms Behind Sequential Segmentation in Tribolium Castaneum

Tribolium castaneum (the red flour beetle) is a model organism used to study segmentation. Unlike the more often utilized *Drosophila melanogaster* (the fruit fly), which segments simultaneously, *Tribolium* segments sequentially. We want to find factors responsible for this difference and how these factors are reflected in the regulation of conserved genes. The *even-skipped (eve)* gene is the focus of this study, as it is fundamental to segmentation in both simultaneous and sequential systems. In *Drosophila*, eve enhancers are stripe-specific, but whether these enhancers are conserved in *Tribolium* remains unknown. Does *Tribolium* need stripe-specific enhancers, or could it use one enhancer repeatedly to generate its stripes? We hypothesize that *Tribolium* enhancers regulating stripe formation can be identified through targeted CRISPR deletion. We used computational tools and ATAC-Seq data to predict enhancer regions. We designed gRNAs to disrupt a genomic region identified as a target of transcription factors that regulate *eve* and indicated by ATAC-seq to be active in the posterior of early embryos. These plasmids, along with a Cas9 expression plasmid, were injected into *Tribolium* embryos. Although there have been suboptimal survival rates of the injected embryos, upon better survival rates, we intend to assay the larvae's DNA for genomic deletions and mosaic effects of the CRISPR-Cas9 knockout. If both are found, we will develop homozygous lines of transgenic beetles and examine phenotypic changes. Through this process of identifying and characterizing *eve* enhancer regions in *Tribolium*, we can elucidate differences in gene regulation underlying the evolution of segmentation.

ASEMS Scholar Training Academy for Research in STEM (STARS)

PI: Jennifer Batchelder, PhD
Co-PI: Rebecca Gomez, PhD
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Coordinator: Leah Callovini, MS
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Sponsors: Gordon and Betty Moore Foundation, Arizona Science, Engineering, and Math Scholars (ASEMS) Program, University of Arizona Graduate College

Jessica Aguayo

Astronomy at University of Arizona

Mentored by Kevin Hainline, PhD and
Sophie Lebowitz (Astronomy)

Stars and Supermassive Black Holes: Exploring the Fitting of AGNs and Star Formation in Galaxies at z = 2-3

Galaxies change over time as stars are formed from dense, cold gas. One way in which star formation in a galaxy can be disrupted is if the gas that forms stars is heated by the light emitted from Active Galactic Nuclei (AGNs). AGNs are bright central regions of a galaxy that can dominate the light of a galaxy as gas and dust falls onto a growing supermassive black hole. AGNs showcase why star formation can be disrupted, which gives insight into the history of the Universe. The goal of this research project is to identify galaxies 9 billion years in the past that have evidence of an AGN. One indicator of AGN activity is via observation of excited ionized gas, like doubly ionized oxygen ([OIII]), although this can be excited by young stars in some galaxies. We have searched for this oxygen emission by looking at galaxy's light in multiple filters and constructing a spectral energy distribution (SED). SEDs help us understand a galaxy's star formation rate and evidence for an AGN using galaxy modeling. We used observations from the James Webb Space Telescope (JWST) to explore a sample of galaxies from 2-3 billion years after the Big Bang with strong [OIII] emission observed from imaging. We generated SEDs for our sample and used Code Investigating GALaxy Emission (CIGALE) to explore whether each galaxy required the additional light from an AGN. Our results showed that only 14 sources with mid-infrared filters have evidence from their SEDs of containing an AGN.

Joe Blickfeldt

Plant Sciences at University of Arizona

Mentored by Mark Beilstein, PhD and Matthew Alcaraz (Plant Science)

Complementation of Tripartite Signaling in Arabidopsis thaliana

To achieve successful reproduction, plants have evolved complex means for overcoming reproductive barriers meant to ensure the compatibility of gametes. In *Arabidopsis thaliana*, a tripartite signaling network is one method used to navigate these barriers. *Catharanthus roseus* receptor-like kinase1-like (*Cr*RLK1L) proteins, namely *BUPS1/2* and *ANX1/2*, form heterodimeric pairs in the cell membrane of the pollen tube and are assisted by LORELEI-like GPI-anchored proteins (LLGs) in the reception of various Rapid Alkalinization Factors (RALFs). Together, these components moderate pollen tube growth through the carpel. Evidence suggests that mechanisms similar to *A. thaliana's* RLK-LLG-RALF complex are highly conserved across flowering plants. Functional conservation of *BUPS* across Eudicots was examined through transgenic insertion of a *Solanum lycopersicum BUPS* gene (*t-SlBUPS*) into *A. thaliana*. While *t-SlBUPS* was transcribed by the microgametophyte, *bups* microgametophytes with *t-SlBUPS* failed to reach and fertilize the megagametophyte. It is unclear whether the failed complementation was due to the differences in *SlBUPS* and *AtBUPS1* or if experimental limitations in transgenic *BUPS* insertion hinder the ability to fulfill function in *bups1* deficient plants. I hypothesize that transformed *AtBUPS1* (*t-AtBUPS1*) in a *bups1*-/- plant will function in place of the null mutant and facilitate fertilization. A plasmid construct was designed with the *AtBUPS1* coding sequence and transformed into heterozygous BUPS1/bups1 *A. thaliana* plants. Plants will be screened for *t-AtBUPS1* and analyzed for transmission of the *bups1* allele by the microgametophyte. Successful complementation by *t-AtBUPS1* would suggest that the failure of *t-SlBUPS* is due to the dissimilarities between the two orthologs.

Beau Carter

Optical Sciences & Engineering at University of Arizona

Mentored by Dalziel Wilson, PhD, Atkin Hyatt, Mitul Dey Chowdhury, Charles Condos, Morgan Choi (Optical Sciences)

Feedback Cooling a Torsional Oscillator using an Optical Lever

Torsional oscillators have become a powerful paradigm for sensing weak forces, enabling fundamental tests of phenomena such as radiation pressure and gravity. A key requirement for these experiments is to cool the torsional oscillator to its motional ground state. We explore ground-state cooling by leveraging two advances: ultralow mechanical loss via a strained Si3N4 nanosuspension, and measurement-based feedback using a quantum noise-limited optical lever. By employing a balanced photodetector, the optical lever becomes immune to classical intensity noise, enabling high measurement efficiency sufficient for effective feedback cooling. An intensity-modulated radiation pressure force from a HeNe laser serves as the actuator. With these components, we evaluate the requirements to cool a torsional oscillator to near 1000 phonons.

Lazaro Cota

Biology: Biomedical Sciences emphasis
at University of Arizona

Mentored by David Margolis, MD, PhD, Gerardo Figuero, and David A. Gonzales
(Biomedical Engineering and Orthopaedic Surgery)

Continuous Monitoring of Fracture Healing Using Wireless Sensors

Bone fractures remain a significant clinical burden worldwide, affecting millions of individuals annually and leading to substantial economic costs. Despite advancements in imaging technology, accurately tracking the healing process of bone fractures in real time remains a challenge. This gap leads us to the research question: Can implantable bone strain gauges be used to continuously monitor bone healing in a sheep model? We hypothesized that for this study implantable bone strain (mechanical deformity) gauges can provide an accurate quantitative assessment of bone healing in sheep compared to radiographs. Sheep underwent sterile surgical preparation and implantation of calcium-coated strain gauge sensors onto femur fracture sites. Sensor function was verified with weekly strain data collection and compared against radiographic imaging. As healing progressed from the soft callus phase to the remodeling stage, a corresponding decrease in strain was observed. There was a 75 percent decrease when comparing the averages from week 4 to week 11, this is correlated to the healing of the bone throughout the weeks. These results suggest that calcium-coated strain gauge sensors offer a promising solution to existing gaps in bone healing research. Ultimately, this work advances the development of continuous monitoring techniques that enhance our understanding of fracture repair and support more effective clinical interventions.

Nicole Digonno

Physiology and Medical Sciences | Spanish
at University of Arizona

Mentored by Sairam Parthasarathy, MD, Kristina Rico, Natalie Provencio Dean, MS, and Christopher Morton (Health Sciences)

Linking Social Care with Healthcare Systems to Address Social Determinants of Health

In Arizona, approximately 1 in 5 residents speaks Spanish at home, which establishes limitations in healthcare that could be addressed by integrating social care into patient care. The Biopsychosocial Model of Healthcare is a conceptual framework that explains how healthcare is influenced by biological, psychological, and social factors. With this encompassing the mechanisms by which patients develop health conditions and their broader implications for treatment outcomes. Physicians are trained to address biological and psychological components of health, while community health workers (CHWs) are professionals who are trained to directly engage with members of the community to connect them to healthcare services and resources. Many of the CHWs who are implemented in clinics are bilingual, which helps to reduce the prominent Social Determinant of Health (SDOH) in Arizona. Language Concordant Care refers to the delivery of healthcare in a patient's primary language to assure effective communication between the patient and clinician. Language Concordant Care has been shown to improve patient outcomes and reduce confusion when educating patients. Since CHWs are mostly bilingual, they aim to reduce the communication barrier that has been implemented. The Arizona Community Education Alliance (AZCEAL) study aims to reinforce the necessity of CHWs as a part of a healthcare team and to give implementation strategies for CHWs by providing a model for the necessary infrastructure to utilize CHWs in clinics. AZCEAL aims to understand how implementation of social care, through the use of CHWs, better addresses SDOHs in high-risk populations to improve patient outcomes within clinical practices.

Elizabeth Fuentes

Veterinary Sciences | Spanish at University of Arizona

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

Temporal and Contextual Repeatability in a Novel Community Science Dog Cognition Task

Community science, where members of the public contribute to data collection, has the potential to expand the scale and diversity of canine cognition research by enabling participation from a wider range of dogs and owners. However, questions remain about whether tasks conducted in less controlled settings produce data as reliable as those implemented by trained researchers. This project focuses on developing and assessing a simplified spatial reversal learning task designed to be used both by researchers in a daycare setting and by dog guardians at home. The study addresses whether performance on this task is repeatable within a single context and whether such an approach could support larger-scale, owner-implemented testing. Preliminary analyses indicate that dog performance on the researcher-implemented version of the task shows a weak positive correlation across two sessions (Pearson's $r = 0.28$, $N = 14$), suggesting limited retest reliability to date. This may reflect environmental variability in daycare settings, small sample size, and the disproportionate influence of a few individuals whose performance differed substantially between sessions. Continued data collection will allow for stronger estimates and future analyses comparing researcher- and owner-implemented data. Establishing that a brief, accessible community science task produces repeatable results would provide evidence for its validity and contribute to the development of scalable methods for studying behavioral flexibility in companion dogs.

Kira Kawena Gomez

Animal Science at University of Arizona

Mentored by Liliana Salvador, PhD and
Luis Alegria (Animal & Biomedical Sciences)

Tracing Zoonotic Tuberculosis in Africa Using Whole-Genome Sequencing

Zoonotic tuberculosis (zTB) caused mainly by *Mycobacterium bovis*, presents a public health challenge globally, particularly where humans, livestock, and wildlife closely interact. While whole-genome sequencing (WGS) has emerged as a tool in detecting and characterizing *M. bovis* transmission, parts of the world – particularly Africa – remain underrepresented in genomic surveillance. This limited coverage obscures the true burden of zTB and hinders our ability to detect cross-species transmission. Our study uses Africa as a case study to examine zTB transmission of *M. bovis* by analyzing publicly available WGS data from human and animal hosts. We hypothesize that genetically clustered isolates will indicate shared strains across species and suggest potential transmission events. We compiled Africa *M. bovis* isolates from NCBI and performed SNP-based clustering and phylogenetic analyses to evaluate host sharing and geographic overlap. Our results show that the human *M. bovis* isolate and cattle-derived isolates from Uganda cluster (~37 SNPs), indicating a shared lineage but not recent interspecies transmission. Conversely, WGS revealed plausible recent transmission events (<12 SNPs) between cattle within Nigeria, Ethiopia, and among wildlife in South Africa. Additionally, based on the available data, countries including Morocco, Uganda, and Ethiopia exhibit high genetic diversity of *M. bovis* strains, while others, like Zambia, show relatively low diversity. These findings demonstrate the use of WGS in identifying potential zTB and bovine TB events and underscore the need for improved One Health surveillance. Results also suggest that the contribution of *M. bovis* to human TB in Africa may be underrecognized in public health data.

Janel Hanna

Biology | Molecular & Cellular Biology
at University of Arizona

Mentored by Erika Eggers, PhD and
Andrea Wellington (Physiology)

Neurovascular Remodeling in the Retina of 5xFAD Mice: A Structural Retinal Biomarker for Alzheimer's Disease

Alzheimer’s disease (AD) is a progressive neurodegenerative disorder that currently lacks early diagnostic biomarkers. The retina shares embryological origin and structural similarities with the brain, making it a promising site for non-invasive detection of neurodegenerative changes. Our study investigates whether AD pathology causes structural remodeling of the retinal neurovascular unit (NVU), focusing on astrocyte and pericyte coverage in 5xFAD mice, a transgenic AD model. Retinas from 9-month-old 5xFAD mice were compared to 7-month-old controls using confocal microscopy with FIJI/ImageJ analysis. Astrocyte-vessel overlap was assessed in the ganglion cell layer (GCL), while pericyte coverage was analyzed across the GCL, inner nuclear layer (INL), and outer nuclear layer (ONL). We quantified area coverage by astrocytes, pericytes, and vessels, and categorized astrocytes by soma position and morphology. Since in vivo retinal imaging cannot resolve cellular-level changes, our analysis clarifies whether AD pathology alters astrocyte-vascular interactions in ways that link clinical imaging with underlying cellular changes, supporting the development of early biomarkers. Despite no change in the total number of astrocytes, 5xFAD retinas exhibited altered astrocyte characteristics, including reduced vascular coverage, fewer somas on vessels, increased somas off vessels, and fewer thickened or coiled processes. These findings suggest that AD pathology disrupts astrocyte-vascular interactions and morphology, contributing to retinal NVU remodeling. We also investigated pericyte distribution with retinal capillaries, and those findings are currently in progress. This will further clarify whether additional vascular support cells are similarly affected in AD.

Fadl Kobeissi

Nutritional Sciences at University of Arizona

Mentored by Geovana Martin-Alemañy, PhD
(Nutritional Sciences & Wellness)

Barriers to Low-Sodium Dietary Adherence Among Hemodialysis Patients: Results from a Survey-Based Cross-Sectional Study

This study used a cross-sectional design to explore barriers to low-sodium dietary adherence among hemodialysis patients in a clinical setting in Southern Arizona. Excess sodium intake contributes to fluid overload, hypertension, and increased mortality among patients with end-stage renal disease, yet sodium-restricted diets are often difficult to follow. The research aimed to identify patient-reported challenges across eight domains: food availability, access, preparation knowledge, social influences, psychosocial barriers, personal preferences, financial limitations, and nutritional awareness. Forty-eight patients completed a structured questionnaire during dialysis treatment. Descriptive statistics revealed several key barriers. Although most participants reported consistent access to cooking facilities and fresh foods, 36% lacked confidence in interpreting nutrition labels or identifying low-sodium options. Additionally, nearly 30% cited financial constraints as a barrier to choosing low-sodium options, and 27% demonstrated limited knowledge about which foods typically contain high levels of sodium. These findings suggest that improving adherence requires more than basic dietary instruction. Addressing gaps in food literacy, affordability, and nutritional awareness may be essential for promoting sustained behavior change. As an early phase of a larger intervention-focused research effort, this study highlights the need for patient-centered strategies to improve sodium restriction adherence and reduce related health risks in dialysis populations.

Alexa Laporte

Applied Biotechnology: Industrial Plant and Microbial Biotechnology emphasis at University of Arizona

Mentored by David E. Hogan, PhD, Raina M. Maier, Tyler J. Durkin, and Kelsey Graves (Environmental Science)

Novel Bio-Inspired Xylolipids: Toward Heavy Metal Remediation Strategy Development

Heavy metal contamination of aqueous systems remains a global concern due to the toxicity and persistence of metals such as lead, cadmium, and arsenic. While synthetic surfactants are effective in facilitating heavy metal remediation, their petrochemical origins raise concerns about their toxicity and biodegradability. This study investigates a new class of synthetic, bio-inspired surfactants – xylolipids, nonionic glycolipids derived from xylose – to explore their surface-active and emulsifying properties and interactions with rhamnolipid biosurfactants. As these molecules are novel and structurally unique, they have not yet been fully characterized. Moreover, studies have shown that anionic and nonionic mixtures of synthetic surfactants exhibit synergistic effects, but such interactions with bio-inspired glycolipids are yet to be explored. Therefore, this study characterizes three bio-inspired nonionic xylolipids using force tensiometry (Du Nouy ring method) to measure both surface tension and critical micelle concentration (CMC) and evaluates emulsification activity via kerosene-based emulsion testing. Additionally, the study explores the interactions in binary mixtures of the novel bio-inspired xylolipids with the more characterized rhamnolipid biosurfactants. Preliminary findings suggest that select xylolipid-rhamnolipid combinations exhibit synergistic effects, lowering surface tension in their binary mixture compared to the surfactants individually. These results indicate potential for customized surfactant systems that could improve the efficiency of heavy metal remediation technologies. With an improved knowledge of synthetic biosurfactant performance and interactions, this work contributes to the development of more effective, tunable, and environmentally conscious remediation strategies.

Brianna Leyva

Neuroscience & Cognitive Science
at University of Arizona

Mentored by Lauren Hartstein, PhD (Psychiatry)

Impact of Light Exposure on 5-6 Year Olds' Circadian Rhythms and Sleep Health

Sleep is a critical component of children's health, influencing their emotional and behavioral development. Both sleep quality and duration are shaped in part by circadian timing, which is regulated by the body's internal clock. Light exposure plays a pivotal role in regulating the circadian clock. Evening light exposure and disruptions to sleep can lead to negative effects on children's health. Despite this, there is a gap in research regarding interventions that could promote early bedtimes and healthy sleep behaviors in younger children. The object of this study is to examine the sleep timing, light exposure, and sleep quality in a community sample of children aged 5-6 years old before and after an intervention aimed at reducing evening light exposure. We hypothesize that adjustment to home lighting environment and blue light-blocking glasses will result in earlier dim light melatonin onset (DLMO), earlier sleep onset, and the interventions will be perceived as feasible and acceptable by the parents and children. Data will be analyzed from the children's actigraphy watches, sleep journals, and salivary melatonin. Parents will complete post-intervention assessments and qualitative interviews to assess the feasibility and acceptability of each intervention. Results from the analyses will indicate whether the two intervention strategies can improve children's sleep health by advancing children's sleep and circadian timing. This study will contribute to further research in understanding how blue light can affect sleep and circadian timing in younger children. It will highlight the importance of developing effective circadian interventions to support healthy sleep patterns in children.

Sailyn Lopez

Molecular & Cellular Biology at University of Arizona

Mentored by J. Ross Buchan, PhD, Jeremy Joseph, and Telsa Mittelmeier (Molecular & Cellular Biology)

Colocalization of Ash1 mRNA with Ded1 and Edc3 in Stress Granules and P-Bodies During Heat Stress

Saccharomyces cerevisiae yeast is a powerful model for investigating fundamental eukaryotic processes, including RNA metabolism and stress response. While gene-tagging technologies have enhanced understanding of protein function, understanding transcriptome-wide mRNA behavior, especially during stress, remains limited. To address this, we are constructing an mRNA tracking library in yeast. Using innovative protein construct tools such as Halo/SNAP tags that allow labelling of mRNA at specific sequences with bright fluorescent, and the MS2-MCP system that allows us to track individual mRNA molecules in cells, our work builds on existing live-cell mRNA imaging methods within yeast models. As proof of principle, we have used these tools to study if the *ASH1* mRNA localizes to cytoplasmic biomolecular condensates implicated in mRNA fate regulation, termed stress granules (SGs) or P-bodies (PBs), following heat shock. Following live-cell fluorescence microscopy of Halo/SNAP-labelled *ASH1* mRNA, and GFP/RFP-tagged protein markers of SGs and PBs, we found that Ash1 mRNA may colocalize to stress granules (SGs) or P-bodies (PBs) during heat shock in *S. cerevisiae*, implying that its translational regulation is responsive to environmental stress. The observed colocalization of *ASH1* with markers Ded1 (stress granules) and Edc3 (P-bodies) may indicate that *ASH1* mRNA may be selectively stored or degraded under stress conditions, potentially to preserve cellular energy or regulate asymmetric protein distribution.

Andrew Marcinko-Hernandez

Biomedical Engineering at University of Arizona

Mentored by David Margolis, MD, PhD and Gerardo Figuroa (Biomedical Engineering and Orthopaedic Surgery)

Integrating Biodegradable Scaffolds with Wireless Electronics for Bone Repair

Fractures and critical-sized bone defects remain major clinical challenges, often resulting in long-term disability or limb amputation when proper regeneration fails. Insufficient stabilization at the defect site can lead to fibrous non-unions, structural failure, and impaired calcification. Conventional treatments such as distraction osteogenesis, bone transport, autografts, and allografts face limitations including donor-site morbidity, immune rejection, and poor tissue integration. These drawbacks have driven interest in patient-specific, regenerative strategies. Three-dimensional (3D) printed scaffolds made from polylactic acid (PLA), a biodegradable and biocompatible polyester, offer a promising alternative. Widely used in biomedical applications, PLA safely degrades *in vivo* through hydrolysis of its ester bonds, producing lactic acid, a natural metabolite processed by the body. When combined with tricalcium phosphate (TCP), these composite scaffolds improve osteoinductivity and support vascular ingrowth, while maintaining mechanical integrity and customizable geometry. In parallel, wireless battery-free devices, like osseosurface electronics, enable real-time monitoring of local strain, impedance, and temperature. These sensors directly attached to bones or implants, allowing continuous post-operative assessment to detect complications and guide clinical decision-making. This study investigates whether the integration of biodegradable PLA-TCP scaffolds with implantable electronics, referred to as "smart scaffolds", enhances bone healing in a sheep femoral defect model. We hypothesize that this dual approach will not only improve bone regeneration outcomes but also provide dynamic, *in vivo* feedback throughout recovery.

Natalia Moreno Hendrickson

Biology: Biomedical Sciences emphasis
at University of Arizona

Mentored by Lee Ryan, PhD and
Lesley Guareña (Psychology)

Early Risk, Lasting Impact: Adverse Childhood Experiences and Racial Disparities in Cognitive Aging

Adverse childhood experiences (ACEs) have been extensively linked to a range of negative health outcomes throughout the lifespan, with recent research suggesting enduring cognitive effects in older adulthood. Executive functions, a set of cognitive processes that support planning, inhibition, and cognitive flexibility, may be particularly vulnerable to early-life stress. While previous studies have demonstrated associations between ACEs and poorer cognitive functioning, few have investigated this relationship within diverse U.S. aging populations. This study aims to investigate whether exposure to ACEs predicts executive functions among older adults, and whether this association differs among Hispanic/Latino and non-Hispanic White adults. Sixty community-dwelling adults aged 50 to 79, including an equal number of Hispanic/Latino and Non-Hispanic White participants, completed cognitive testing and psychosocial assessments as part of a larger longitudinal aging study. Executive functions were operationalized via validated cognitive tests, and ACEs were measured using a modified version of the Childhood Trauma Questionnaire. Linear regression analyses will be used to examine the association between ACE scores and executive functions performance. Models including race/ethnicity will also be implemented to assess for racial/ethnic group differences. Findings are expected to clarify whether ACEs influence executive functions in later life and whether this relationship differs between racial/ethnic groups. Results will contribute to a growing life-course perspective on cognitive aging and inform trauma-informed approaches to healthy aging.

Paige M. Navarrete

Natural Resources: Wildlife Conservation and Management emphasis at University of Arizona

Mentored by Bret Pasch, PhD, Sean Mahoney, Nikki Reck, and Vicki Greer
(Natural Resources & the Environment)

Influences of Climate on an Endangered Squirrel Population and Food Availability in the Southwest United States

Models utilizing localized data have been shown to more accurately represent population size in species of great concern. In Arizona, the endangered Mt. Graham red squirrel (Tamiasciurus fremonti hudsonicus; MGRS) population is vulnerable to forest disturbance and fluctuations of food resources due to its isolation to the Pinaleño Mountains. This habitat is located within a range of the Southwest United States influenced by a unique bimodal precipitation system that supplies the majority of precipitation in an otherwise arid landscape. Currently, there is limited research on the effects of local precipitation and drought on the Mt. Graham red squirrel population. This study aims to take advantage of a long-term data set to investigate the effects of bimodal precipitation volume and temperature on seed and mushroom abundance within MGRS habitat using a set of times series analyses. Resulting trends reveal MGRS sensitivity to seed abundance and rising annual temperatures. While local precipitation influences mushroom abundance, a lack of influence on seed abundance may emphasize the importance of conserving forest and midden structures for seed resource maintenance. Updated assessments of the findings within this study will be necessary as climate extremes increase in frequency and severity throughout the American Southwest. Through the analyses of such ecological relationships, life history models for MGRS may be updated to better inform management decisions for the species and increase adaptive management capabilities.

Michael Nguyen

Pharmaceutical Sciences at University of Arizona

Mentored by Patrick Ronaldson, PhD and
Collin Krzyzaniak, MS (Medicine)

Investigation of Acetaminophen's Alteration to Efflux Transporters through Nuclear Receptors in the Blood-Brain Barrier

Acetaminophen (APAP) is the most frequently consumed analgesic drug in the United States with a relatively high safety profile. However, the Ronaldson lab has made tremendous strides in researching APAP's effects on the blood-brain barrier (BBB) efflux transporter proteins, P-glycoprotein and Breast cancer resistance protein (P-gp and Bcrp, respectively), causing concern for potential drug-drug interactions. Our objective is to investigate the mechanisms behind APAP-induced upregulation of P-gp and Bcrp functional expression. We hypothesize this occurs through constitutive androstane receptor (CAR) and pregnane x receptor (PXR) activation and nuclear translocation, thereby promoting transcription of P-gp and Bcrp. To investigate this, we will utilize an in vitro brain endothelial (b.End3) cell model and treat with I) vehicle control (DMSO), II) low-dose APAP (0.05 mM), III) high-dose APAP (0.5 mM), and IV) the main APAP metabolite NAPQI (0.5 mM). To observe CAR and PXR nuclear localization, we will perform immunofluorescent staining to visualize nuclear colocalization to compare vehicle control versus treated cells. While our full data set has yet to be compiled, we expect to see increased nuclear translocation of CAR and/or PXR when comparing treated versus vehicle controls. These findings will uncover the mechanism by which APAP alters BBB efflux transporter proteins, P-gp and Bcrp.

Zacariah Padron Murrieta

Molecular & Cellular Biology at University of Arizona

Mentored by Jil C. Tardiff, MD, PhD and
Logan Radomsky, MS (Biomedical Engineering)

W7 as a Therapeutic Modulator of Sarcomeric Dysfunction in R92W-cTnT Mutant Cardiomyopathy

Hypertrophic cardiomyopathy (HCM) is a heritable cardiac disorder marked by hypercontractility, myofibrillar disarray, and increased risk of sudden cardiac death in young adults. A well-studied mutation in cardiac troponin T (cTnT), Arginine-92-to-Tryptophan (R92W), disrupts thin filament regulation and increases myofilament calcium sensitivity, contributing to the disease's development. Current treatments for HCM do not directly address mutation-specific mechanisms, proving the need for precision therapeutics. This project investigates W7, a small-molecule inhibitor known to stabilize the closed conformation of cardiac troponin C (cTnC) and decrease calcium-induced activation of the thin filament. We ask whether W7 can mitigate the hypercontractile effects of the R92W mutation by reducing ATPase activity and normalizing calcium sensitivity in mutant myofibrils. To explore this, we isolated cardiac myofibrils from transgenic mouse models expressing the R92W mutation and conducted NADH-coupled ATPase assays under controlled calcium concentrations to assess functional contractile parameters. Our results demonstrate that W7 decreases sarcomere ATPase activity in R92W-mutant myofibrils, providing evidence that the R92W mutation involves calcium handling abnormalities that can be modulated by W7. These findings support W7 as a proof of concept compound, highlighting its utility in revealing mutation specific mechanisms and its potential as a foundation for developing mutant-targeted therapies for HCM.

Alondra Salazar Valencia

Medicine at University of Arizona

Mentored by Jennifer A. Teske, PhD
(Nutritional Sciences & Wellness)

Noise Exposure and Socioeconomic Status: A Gap in Frequency Reporting

High noise exposure directly associates with auditory (e.g., tinnitus) and non-auditory (sleep disruption, co-morbidities) health conditions. Noise exposure may contribute negatively to health disparities, which worsen as SES declines, since sources that generate noise are in close proximity to neighborhoods with a lower SES. The relationship between noise and SES in the southwest remains unknown. Preliminary studies in Tucson, AZ showed that noise intensity was higher in lower SES locations but this relationship was influenced by the frequency of the noise. The purpose here was to conduct a mini-literature review to identify frequency bands in studies that determined the relationship between noise and SES and test the hypothesis that noise in all frequency bands would be greater in areas with a low SES in Tucson, AZ. A literature search (pubmed.gov, keywords environmental noise and socioeconomic status, 2015-2025, English language) identified 287 articles. 168 were excluded based on the abstract. 145 full-text articles (n=119 literature search and n=26 an Honor's thesis) were reviewed for how noise was measured, SES indicators, frequency bands and study location. 27.8% of the articles measured noise in the U.S., 57.2% estimated noise, 9.7% measured noise with a device (0% smartphone), 15.9% used surveys to understand noise perception, 11% were reviews, 6.2% didn't report noise and zero reported frequency. Common SES indicators included income, education, occupation, and home value. Identifying how noise frequency influences the relationship between noise intensity and SES is crucial to minimizing noise-induced disparities.

Asmaa Salih

Biology at University of Arizona

Mentored by Purnima Madhivanan, PhD, MBBS, MPH
and Rogelio Robles-Morales, MD (Public Health)

Generational Status and the Correlation to Preferences for Self-Sampling versus Provider Sampling for Cervical Cancer and Human Papillomavirus

Healthcare among minority groups continues to be impacted by health disparities. While the main factors of disparities can be attributed to differences in race and ethnicity, other factors that come into play include the patient's sexual orientation, generation, and socioeconomic status. This study will focus on investigating the impact that generational status has on minority women's perceptions of healthcare while addressing their experiences in the context of cervical cancer and human papillomavirus (HPV) screening. The primary objective is to assess generational differences regarding self-sampling versus provider sampling. A cross-sectional survey is being conducted for 500 participants, specifically women between the ages of 25-65, receiving preventative screening tests for cervical cancer and HPV. Demographic data that includes the patient's generational status is being collected, alongside several qualitative and quantitative components. This study will be based on the preferences that patients have for self-sampling and screening protocols and methods. Patient responses to specific statements are analyzed using a Likert scale, then recorded and filed electronically. An in-depth analysis will then be made on the association between generational status and preference for sampling. Although this study is limited in its population demographics, it still provides valuable data for comparison to other minority groups in the United States for qualitative analysis. In-depth research on how society can enhance measures in place for preventive care can help the overall patient experience and, as a result, encourage individuals to remain health-conscious without concerns for discrimination based upon the factors previously mentioned.

Jonathan Sigona

Mathematics | Statistics & Data Science
at University of Arizona

Mentored by Alexander Bucksch, PhD (Plant Science)

FiberWalk: A Probabilistic Model of Plant Root Architecture

The goal to understand the rules of plant life yielded many discoveries toward understanding the formation of plant phenotypes. Such discoveries are important for advancing sustainable agriculture to combat global issues like climate change and food shortages. An active research area is plant roots, which receive less attention because they are buried in the opaque soil. But even if excavated, the vast variation in plant root architecture poses challenges to make statistical inferences on collected trait data. To fill the gap in knowledge and account for the variation seen in nature, we hypothesize that a probabilistic mathematical model may be the best way to predict the formation of phenotypes in plant root architecture. Our approach is distinct from typical models in plant biology created based on experimental data., Our mathematical model functions independently without prior knowledge of any plant root measurement and explores the possible morphologies arising from two growth processes – elongation and lateral expansion. We created the model in a two-dimensional space based on a self-avoiding random walk. Our demonstration software accepts user inputs of probability distributions and parameter values to determine the root architecture. Future work on the model will aim to simulate the root growth in a three-dimensional space, allowing for the validation of the model in a realistic case. Successful validation of the model will allow us to predict occurrences of architectural root phenotypes in nature, which may lead to research that optimizes resource uptake for specified plant root architecture.

Roman Valle

Physics at University of Arizona

Mentored by Tai Kong, PhD, Jeremy Philbrick, Brianna Billingsley, and Ali Taha Habiboglu (Physics)

Crystal Structure and Magnetic Properties of Transition Metal (Ta, Cr, V; Mo, Fe) Based Inorganic Compounds for Magnetic Applications

The increasing global demand for magnetic materials has highlighted the vulnerability of supply chains that rely on rare earth elements (REE). Many of these are considered 'critical materials' due to their scarcity, cost, environmental and geopolitical sourcing risks. This project explores alternatives in the form of REE-free and REE-lean compounds that exhibit magnetic properties comparable to REE materials. Specifically, our focus is on two families of compounds: (1) transition metal phosphides of the form Ta–Cr–P and Ta–V–P, and (2) ternary intermetallic systems of the form Mo-Fe-Si. These family compounds were selected due to their structural tunability, underexplored physical behavior, and compatibility with commonly available synthesis and analysis techniques. This research is guided by an exploratory, data-informed methodology centered on experimental materials synthesis and structural characterization. This research aims to fill a gap in the current understanding of how specific element substitutions (such as replacing Cr with V) may influence phase stability, crystal structure, and potential magnetic behavior. To date, synthesis and X-ray diffraction analysis have confirmed the successful formation of the Ta-Cr-P target phase, that being TiNiSi-type structure at room temperature. Physical property measurements were conducted; Nonmagnetic first order phase transition was found in TaCrP at around 250K. Further trials are ongoing for Mo-Fe-Si and Ta-V-P. Once structural confirmation is achieved, physical properties such as temperature-dependent magnetic susceptibility and thermodynamic behavior will be measured. This project contributes to the growing effort to identify REE-free alternatives by categorizing the ternary systems that may support future magnetic applications.

Raksha Vikram Aditya

Neuroscience & Cognitive Science: Neurobiology emphasis | Biochemistry at University of Arizona

Mentored by Paulo W. Pires, PhD and Paige Martin (Physiology)

Comparing Vascular BK_{Ca} Channel Function in Aging and Alzheimer's Disease

Alzheimer's disease (AD) not only affects memory and cognition but also disrupts cerebral blood flow, partly through changes in vascular smooth muscle cell function. Large-conductance calcium-activated potassium (BK_{Ca}) channels are key regulators of vascular tone, and both aging and AD have been associated with impaired BK_{Ca} function. However, it is unclear whether this dysfunction arises from similar molecular mechanisms in both conditions. In particular, the role of oxidative post-translational modifications (PTMs) in BK_{Ca} dysfunction during aging versus AD remains poorly understood. This project compares BK_{Ca} channel function in aged wild-type mice and *5x-FAD* Alzheimer's mice to young, healthy controls using single-channel patch clamp electrophysiology. To test the role of oxidative PTMs, I isolated vascular smooth muscle cells from cerebral arteries and recorded BK_{Ca} activity after exposing the intracellular membrane face to calcium alone and then to calcium plus dithiothreitol (DTT), a reducing agent known to reverse oxidative modifications. This approach helps determine whether suppressed channel function is related to reversible changes like S-nitrosylation, which can reduce calcium sensitivity and alter gating behavior. Perforated patch clamp was also used in aged mice to assess baseline BK_{Ca} activity without disrupting intracellular signaling. Although data collection is ongoing, I predict that both aged and AD mice will show reduced BK_{Ca} activity compared to younger controls. If DTT improves channel activity, it would suggest that oxidative PTMs contribute to the dysfunction. Comparing responses between groups may reveal whether AD amplifies age-related changes or introduces distinct pathological mechanisms.

Kulindu Vithanachchi

Microbiology at University of Arizona

Mentored by Nathan Cherrington, PhD and Paxton Alan Sample (Pharmacy)

Effects of Cyclic Heat Stress on the Ability to Metabolize Drugs Observed in Rats

The Cherrington lab and others have previously shown that metabolic dysfunction-associated steatohepatitis (MASH) leads to inflammation, altered transporter activities, and improper drug metabolism. Heat stress causes heat strain, which also has inflammatory symptoms. Additionally, the lethal dose for 50 percent of the population of drugs can be altered significantly by heat stress. Lastly, global climate temperature is increasing. This paper investigates the relationship between chronic heat stress and drug metabolism, which is observed by phase 1 drug metabolizing enzyme (DME) activity. We hypothesize that rats exposed to chronic heat stress will have a change in drug metabolism compared to rats housed in control conditions. Protein, RNA, blood, urine, and microsomes are taken from rats at the end of their experimental treatments (either cyclical heat stress or controlled temperature for 7 days) in a pharmacokinetics (PK) study. Preliminary results suggest that heat strain will change DME function. Additionally, it is expected that we will find that rats exposed to chronic heat stress will have altered DME activity and concentrations of parent drugs in their urine or blood will be different of rats in the control group. The results of this research will provide insight into whether there is a change in DME function when exposed to cyclical heat stress. Considering how people can change environments quickly, this research suggests that more personalized prescriptions are important.

Jessica Wysong

Medicine: Basic Medical emphasis, BS
at University of Arizona

Mentored by Ashley Snider, PhD and Keila Espinoza
(Nutritional Sciences & Wellness)

Acid Ceramidase as a Potential Therapeutic Target in Ulcerative Colitis

Inflammatory bowel disease (IBD) is a condition characterized by persistent mucosal inflammation, which can lead to the development of ulcerative colitis or Crohn's disease. Sphingolipids play a crucial role in the signaling pathways that influence inflammation in IBD. In particular, acid ceramidase (AC), a lysosomal enzyme involved in sphingolipid metabolism, may contribute to the recruitment of immune cells and the facilitation of pro-inflammatory responses. However, the mechanistic role of AC in chronic disease models remains unclear. Therefore, this study investigates the loss of AC in myeloid cells using an interleukin-10 (IL-10) knockout mouse model, which develops spontaneous colitis that more accurately reflects the relapsing course of disease observed in human patients. To do this, IL-10 knockout mice were crossed with AC conditional knockout mice to generate ACMYE/IL10-/- mice, and ACfl/fl/IL10-/- mice were used as controls. We hypothesized that the absence of AC would lead to decreased immune cell infiltration and reduced intestinal inflammation. To test this, we cultured bone marrow-derived macrophages and conducted polarization assays to explore mechanisms of immune cell recruitment. We found that AC deficiency reduced polarization of macrophages to a pro-inflammatory M1 phenotype and decreased phagocytic activity of M2 macrophages. Furthermore, AC loss impaired macrophage recruitment to inflammatory sites. These findings suggest that AC plays a regulatory role in macrophage function during intestinal inflammation. Altogether, this study provides insight into the role of AC in chronic colitis and may inform the development of sphingolipid-targeted therapies for IBD.

Zoe Xanthos

Biochemistry | Applied Biotechnology
at University of Arizona

Mentored by David Baltrus, PhD (Plant Science)

Supporting That ComEA Protein Assists in Uptake of DNA in Pseudomonas stutzeri

Bacteria are diverse organisms, many species providing numerous advantages in research, including antibiotic resistance, models for biotechnological advancements, and genetic diversity. These are only a few examples of how some bacteria, through their ability to uptake DNA, can be vital in research; this advantage of accepting foreign DNA is called natural competence. One mechanism of DNA uptake utilizes a gene called *comEA*. This gene translates the protein ComEA, which binds and guides exogenous DNA into the cytoplasm. Although numerous species of bacteria are known to utilize the comEA gene, it is currently unknown if *Pseudomonas stutzeri* (*P. stutzeri*) requires this gene to accomplish natural transformation. Our study utilizes standard DNA editing techniques to delete the *comEA* gene from *P. stutzeri* and determine if it is capable of DNA uptake in the absence of the gene. However, we hypothesize that *P. stutzeri* will not be able to uptake DNA with the *comEA* gene deletion. We will then knock in the gene to confirm that the ComEA protein is truly necessary for *P. stutzeri* to undergo natural transformation. This study addresses an existing gap in knowledge by confirming the natural competence protein mechanism in *P. stutzeri*. Investigating how *P. stutzeri*, a soil-dwelling bacterium found across the globe, incorporates new DNA into its genome points to its robust evolution and survivability.

Environmental and Earth Systems Research at Biosphere 2 (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

Dominick Bute

Environmental Sciences and Sustainability at
Chandler-Gilbert Community College

Mentored by Greg Barron-Gafford, PhD and Nesrine Rouini (Geography, Development & Environment)

Sunflowers Adapt to Agrivoltaic Shade Through Morphological and Leaf Trait Responses

Agrivoltaics is a land-use strategy that integrates agriculture and solar energy, promoting sustainability, efficient land use, and climate resilience. We applied this model to a hot, semi-arid region in Oracle, Arizona, at Biosphere 2, to evaluate morphological and photosynthetic responses of Dwarf Sunspot Sunflowers. The experiment included two plots: an agrivoltaic (AV) plot beneath a checkerboard-patterned solar array providing variable sun/shade, and a full-sun control. Five plants from each plot were sampled. Basal and apical shoot diameters and shoot length were measured with digital calipers. Five fully expanded leaves per plant were assessed for area using a LI-COR 3100 meter and thickness with a caliper. Leaves were weighed for wet mass, dried at 65 °C, and weighed again for dry mass. Plant height was also recorded. Specific leaf area (SLA) was calculated from dry mass and leaf area. To connect these traits to physiology, photosynthetic acclimation was measured on five plants per plot using LI-COR 6400 gas analyzers at 7 a.m.

Preliminary findings show AV-grown sunflowers developed distinct morphological and photosynthetic traits versus full-sun counterparts. In the AV plot, plants had thinner leaves and higher SLA, indicating shade adaptation. Higher SLA enhances light capture, and thinner leaves improve light-use efficiency. Photosynthesis light response curves revealed that AV plants had higher rates at low light (PAR) levels. These results suggest Dwarf Sunspot Sunflowers exhibit adaptive morphological and physiological changes to shaded environments, making them promising candidates for intermediate-shade agrivoltaic systems in hot, semi-arid climates.

Taleya Delaney-Dye

Molecular & Cellular Biology at University of Arizona

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

Investigating Carbon Flux of Natural Desert Plots as Context for Early Succession on a Controlled Basalt Hillslope

Understanding how carbon moves through early-stage ecosystems compared to mature natural systems matters not only for land restoration on Earth, but also for designing life-supporting landscapes on other planets. In this study, we investigate how flux dynamics across early-stage colonizers on a controlled basalt landscape compare to their natural desert counterparts, and what this reveals about succession in model terraformation environments. The Landscape Evolution Observatory (LEO) in Biosphere 2 is a large-scale laboratory made up of three controlled basalt hillslopes. What began as an inert substrate was gradually colonized by cyanobacteria-dominated biocrusts and *Funaria hygrometrica* mosses from the surrounding desert environment. Using a LI-COR LI-850, we measured CO_2 and water vapor flux across moss dominated, biocrust dominated, and bare basalt plots on LEO's west slope with each representing a distinct stage in ecological succession. We compared these measurements to fluxes from outdoor desert soil plots in the surrounding area, where the same organisms occur in a fully natural environment. This comparison allows us to assess how closely LEO mirrors real world flux dynamics both in overall scale and diurnal behavior. Preliminary results from our diurnal measurements suggest that biological cover type has influence on CO_2 and H_2O flux patterns. This work supports LEO as an experimental model for early-stage terraformation where different surface coverage represents successive stages in landscape evolution. These findings are relevant to modeling carbon cycling in both non-terrestrial and terrestrial systems.

Jasiella Grandy

Biochemistry | Biology at Berea College

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

Soil Cover Type and Positions Impact Carbon Accumulation in the Landscape Evolution Observatory (LEO) Soil

The Landscape Evolution Observatory (LEO), located inside Biosphere 2, uses three large slopes comprised of ground basalt that have been exposed to simulated weathering, like rain, and microbial activity. The LEO allows for the study of soil evolution in a controlled environment with limited variables, and numerous sensors allow for observations of the soil evolution with minimal interference. This study aimed to analyze how the surface cover type and slope position impact carbon accumulation. For this research, soil was collected from the surface of three different slopes and six positions on each slope. Of these six positions, the samples were collected beneath moss (M), biocrust (C), or bare (B) soil surfaces. Carbon accumulation is a key factor in soil formation and a Total Organic Carbon Analyzer was used to measure total carbon concentrations in pre-ground soil samples that were run in triplicate. The results showed that the total carbon concentration in the moss and biocrust samples tended to be higher than that in the bare soil samples. The results also show that while the total carbon concentration showed inconsistent trends based on slope position for both biocrust and bare soil, the moss soil samples show an increase in carbon at lower slope positions on all three slopes. This research helps us better understand soil development and the influence of biotic factors in a way that has not been possible in a natural setting.

Jocelyn Hillhouse

Plant Biology at University of California, Davis

Mentored by Katerina Dontsova, PhD and Clement Lopez-Canfin, PhD (Environmental Science)

Continuous Measurements of Net CO2 and H2O Gas Exchange Associated to CAM-Photosynthetic Cacti in Open-Dynamic Mesocosm Chambers

Drylands cover nearly half of the Earth's land surface but are underrepresented in current Earth System Models. As a result, they constitute a major source of uncertainty in projected climate–carbon cycle feedbacks. Drylands host many plant species that use Crassulacean Acid Metabolism (CAM), a specialized photosynthetic pathway that maximizes water use efficiency by enabling nocturnal stomatal gas exchange. Continuous measurements of the net gas exchange associated to CAM-dominated drylands are particularly scarce compared to other ecosystems. Here, we characterized the net CO2 and H2O gas exchange in a semi-controlled analogue of a dryland ecosystem dominated by the Cardon cactus (Pachycereus pringlei). This was performed by using replicated mesocosm environments (clear chambers filled with soil and young Cardon cacti from the Sonoran Desert) instrumented as open-dynamic (steady-state through-flow) chambers. We observed consistent diel patterns in both CO2 and H2O net gas exchanges: (1) net CO2 emissions during daytime in contrast with net CO2 uptake during nighttime, indicating that CO2 absorption rates by cacti exceeded soil respiration rates at night; (2) higher daytime evapotranspiration rates, indicating that soil evaporation overrode the CAM transpiration signal. These results show that, in CAM-dominated drylands, biological CO2 uptake at night can contribute significantly to net ecosystem exchange. Therefore, understanding the rates and drivers of photosynthetic CO_2 uptake across CAM species and environments is essential to improve the accuracy of carbon cycle models. Ongoing work aims to partition net CO_2 and H_2O fluxes into respiration/photosynthesis and evaporation/transpiration to estimate cactus water-use efficiency.

Olivia Lasley

Environmental Science at University of Arizona

Mentored by Holly Andrews, PhD and Ingrid Holstrom
(Geography, Development & Environment)

Influence of Photovoltaic Systems and Plastic Mulch on Dust Accumulation in Arid Environments

As climate pressures reduce farm profitability, we are seeing more croplands left fallow producing aeolian dust that is harmful to human health, negatively impacts agricultural productivity and photovoltaic (PV) panel efficiency. Agrivoltaics systems, where plants grow under the solar arrays, are being increasingly explored because they represent a climate-smart approach to agriculture and offer social and economic benefits. In this study, an existing PV system is being partially converted to an agrivoltaics, allowing for a direct comparison of aeolian dust deposition. We compare aeolian dust accumulation under two plots with differing sun exposure: (1) under the PV array, (2) in full sun; and two different types of soil treatment: (1) rows that were only tilled and (2) rows that were tilled, then treated with compost and covered with plastic mulch. We analyzed the effect PV arrays have on mitigating aeolian dust accumulation of fallow agricultural soils in arid regions, and the extent to which plastic mulch coverings have on the susceptibility of soils to wind erosion at solar farms. We found dust accumulation was greatest at 0.15m, and lowest at 1.0m. Significantly less dust accumulated within the solar array than in the control; however, no significant effect was shown by the plastic mulch treatment. These results show how aeolian sediment travels throughout solar arrays and plastic mulch does not mitigate dust erosion from agrivoltaic land.

Carl Lawrence

Plant Sciences at Cornell University

Mentored by Scott Saleska, PhD, Aaron Bugaj, and Wei-ren Ng (Ecology & Evolutionary Biology)

Carbon dioxide and water dynamics along successional gradients on an experimental early-successional basalt landscape.

As humanity looks to the habitation of other worlds, a key question is to understand how landscapes change as life colonizes, assembles, and transforms inhospitable landscapes into healthy sustainable ecosystems. A critical need for such investigation is to quantify and explore the relationship between landscape evolution and the fluxes of key bioactive trace gases. Here, we investigate how fluxes of water (H2O) vapor and carbon dioxide (CO2) change with development stages along an experimental early successional hillslope of basalt parent material. Within the unique facility of the Landscape Evolution Observatory (LEO), a large-scale laboratory for the study of landscape terraformation, we used flux chambers to assess how flux dynamics changed with successional transitions in which bare soil (crushed basalt parent material) was colonized first by cyanobacterial crusts (“biocrusts”) and then by biocrust-moss associations as the landscape developed. Utilizing one hillslope of LEO as a testbed, we collected flux measurements from the three different successional stages (bare soil, biocrust, and moss). These measurements were made with surface flux chambers (~100 cm2,) and encompassed day vs night time periods under of dry, moderately wet and wet soil conditions. Preliminary CO2 and H2O fluxes showed trends with the successional stage and with soil moisture that provide valuable insights into the process of landscape terraformation.

Lara Matheson

Environmental Science | Economics at Skidmore College

Mentored by Joseph Hoover, PhD and Chrisa Whitmore (Public Health)

Assessing environmental health hazards and social vulnerability: A spatial analysis of contaminants in southern and central Arizona

Exposure to environmental health hazards is a growing concern across the United States, disproportionately affecting vulnerable communities. Previous research has shown that underserved communities are more vulnerable to environmental health hazards including effects from legacy and on-going mining activities. Arizona's extensive mining history presents an ideal study site to evaluate potential relationships between community vulnerability and environmental contaminants. Using the reanalyzed data from the National Uranium Resource Evaluation (NURE) database and the CDC/ATSDR social vulnerability index (SVI), this study 1) assessed the spatial relationships between and among seven environmental contaminants (U, As, Pb, Sc, Ce, Y , and La) and 2) measured the spatial autocorrelation between these environmental contaminants and social vulnerability of census tracts in southern andcentral Arizona. Findings suggest two groups of strongly correlated contaminants: 1) arsenic and lead; and 2) rare earth elements. However, no linear relationships were observed between any of the analytes and SVI. Further analysis demonstrated spatial concurrence of analytes and SVI in select census tracts. Findings from this analysis may provide Arizona communities, environmental health researchers, and others with additional information about where potential exposures to deleterious environmental contaminants may be occurring in central and southern Arizona. Future research could build off this analysis through community-focused research with engagement activities to refine the opportunities to diminish exposures and improve health and wellbeing.

Darnilla Samuel

Chemistry at University of the Virgin Islands

Mentored by Joseph Hoover, PhD and Anu Sethuraman (Public Health)

Analyzing the spatial and seasonal variations of the Gadolinium (Gd) anomaly in surface water at sampling locations along the Animas and San Juan River in New Mexico, Utah, and Arizona

Gadolinium (Gd) is a rare earth element (REE) widely used in magnetic resonance imaging at facilities around the globe; This REE is a conservative indicator of wastewater mixing in riparian systems and an emerging microcontaminant due to its potential human health impacts. In arid lands, such as the US Southwest, wastewater effluent is a critical water resource for sustaining riparian habitats during periods of extended, diminished precipitation. Despite the critical role of wastewater effluent there remains relatively little previous research investigating the presence and enrichment of Gd in surface water of northeast Arizona, home to extensive agriculture, ranching, and tribal communities. The aim of this study is to 1) characterize the presence of anthropogenic Gd in surface waters of northwest New Mexico, and 2) evaluate spatial patterns in the occurrence of Gd enrichment relative to potential sources (such as medical facilities and wastewater treatment plants) at sampling locations along the San Juan River in New Mexico, Utah, and Arizona. Water quality data were extracted from the National Water Information System (NWIS) and normalized using the North American Shale Composite. Gd anomalies were calculated using linear interpolations (Sm/Tb, Nd/Dy, and Nd/Tb) and a 3rd order polynomial interpolation, and results were mapped using ESRI ArcGIS Pro software. Results indicate anomalous Gd concentrations near Farmington, New Mexico, spatially proximal to medical and wastewater facilities. Recommendations for future studies include assessing for seasonal trends in Gd anomalies and further investigating spatial patterns of calculated anomalies along the San Juan river.

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Can tropical leaves thermoregulate to withstand high temperatures in a warming world?

Biosphere 2 Tropical Rainforest (B2-TRF) is the hottest rainforest on earth, which allows studies of how plants adapt to increasing temperature before tropical forests on earth reach those temperatures. In our study, we examined how well plants can thermoregulate by measuring the difference between leaf and air temperature in different tropical plants. Sixteen canopy meteorological stations, measuring air and leaf temperature, humidity, and photosynthetically active radiation, were installed throughout B2-TRF onto *Pachira aquatica*, *Theobroma cacao*, *Clitoria fairchildiana*, *Hibiscus tiliaceus*, *Pterocarpus indicus*, and *Aleurites moluccanus*. Each station had eight thermistors which were installed on four shade and sun leaves, respectively. Leaves from the trees being studied were collected to measure stomatal density, stomatal length, and specific leaf area. The results of this study will allow us to see how leaf temperature relates to air temperature, and how this is correlated to various leaf traits. We will be able to compare between different species, and also within the same species by comparing sun-exposed and shaded leaves, and also comparing different trees of the same species. Findings could give insight into which plant species or traits are most adaptable to withstand higher temperatures, as temperatures in tropical forest rise globally.