Minimizing Health Disparities

Coordinator: Holly Lopez

Sponsors: Western Alliance to Expand Student Opportunities (WAESO), Building Undergraduate Infrastructure Leading to Diversity: Southwest Consortium of Health-Oriented Education Leaders and Research Scholars (BUILDing SCHOLARS)-University of Texas, El Paso, University of Arizona Graduate College

Rebeca Acevedo Barboza

Biological and Natural Resource Science at Northern

Arizona University, Yuma

Mentored by Dr. Jesse Woodson (Plant Science)

Screening and characterization of activation tagged mutants in Arabidopsis thaliana

ABSTRACT: Plants are undergoing constant environmental changes and as non-motile organisms, plants have the need to survive by evolving complex mechanisms. These mechanisms allow plants to be able to sense and respond to any environmental changes. By understanding how plants use these mechanisms in Arabidopsis thaliana, we can implement this knowledge to help other agricultural plant organisms to grow and have a better response to climate change as well as having a better and larger crop yield. Discoveries like these can also help combat global hunger disparities and generate less food waste.

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TBA

ABSTRACT: TBA

Jerry Carr

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Mentored by Dr. Anne Wertheimer (Applied BioSciences)

Cytotoxic Similarities Among Rattlesnake and Scorpion Venoms

ABSTRACT: Bark scorpions (*Centruroides sculpturatus*) are widely known as the most dangerous scorpion in North America. In 2013 the Arizona Poison Control Center reported >18,000 scorpions stings with 691 outcomes labeled as “moderate, major, or death” with children being most the affected group. However, death from a scorpion’s sting is rare due in part to Anascorp, a scorpion antivenom brought into the US market by the VIPER Institute. At VIPER, we aim to compare the cytotoxic properties reportedly found in bark scorpion venom to those found in rattlesnake venom. Bark scorpion venom was collected using electro stimulation and compared to two species of rattlesnake venom, *Crotalus atrox* and *Crotalus adamanteus,* on an SDS PAGE gel. We then tested the bark scorpion and rattlesnake venoms on human neonatal foreskin fibroblast cells, grown at 37°C in IMDM+10% FBS media without antibiotics and venom added at two time points, 4 hours and 24 hours. Further tests were done to analyze the ability of Anivip, a rattlesnake antivenom, to inhibit the cytoxic effects of bark scorpion venom after 2 hours. Cells were incubated with a LIVE/DEAD cytotoxicity/ viability stain and then imaged on an ECHO revolve microscope at 4x and 10x magnification. Results show *Centruroides* venom produces similar protein banding to that seen in *Crotalus* in an SDS PAGE Gel. Based on the ECHO images, *Centruroides* venom is cytotoxic to human cells and greatly reduces cell confluence, similar to that seen in *Crotalus* species. Furthermore, Antivip may have some inhibitory effects on *Centruroides* venom, however further analysis is required. In conclusion, *Centruroides sculpturatus* venom likely contains proteins that cause analogous effects to those found in *Crotalus atrox* and *Crotalus adamanteus* venoms.

Estevan Cleveland

Biochemistry at University of Arizona

Mentored by: Dr. Marvin Slepian (Medicine)

Instrumenting Blood Platelets for Development of Shear Mediated Sensor

ABSTRACT: Single-stranded DNA (ssDNA) origami structure and function allow for the utilization in mechanosensitive applications and detection. The use of platelets allows for a biocompatible sensor that can be used for a wide range of diagnosis of upstream and downstream production of blood components. Herein we discuss the development of ssDNA origami tagged platelets for the use in biosensor applications. Biotinylated ssDNA origami were linked via ssDNA-cholesterol bridge to platelets and analyzed with flow cytometry for binding. Analysis resulted positive for binding, however the protocol also generated platelet microparticles that also resulted positive for ssDNA origami binding.

Ericka Garcia

Microbiology at San Diego State University

Mentored by Dr. Julie Miller (Neuroscience)

Acoustic Alterations in Aging Birdsongs as a Model for Humans

ABSTRACT: Middle-aged and elder adults are projected to encompass 20% of the population by 2060 and a significant percentage have vocal disorders. Vocal disorders are indicated when people have noisier or breathier voice. The specific biological mechanisms by which the aging brain contributes to vocalizations are not fully understood. We use the zebra finch songbird as a model system to understand these processes. The goal is to create better treatments for age-related vocal disorders.

Gabby Grajales

Nutritional Sciences at University of Arizona

Mentored by Dr. Jennifer Teske (Nutritional Sciences)

Can validated smartphone apps detect differences in local noise levels?

ABSTRACT: Noise pollution diminishes quality of life by disrupting sleep, work, and daily activities. Approximately 104 million individuals in the U.S. were exposed to a noise intensity >70 dBA and were at risk of noise-induced hearing loss. Elevated stress and decreased quantity and quality of sleep are also due to elevated noise levels. Few studies have compared the inequality of noise pollution in communities with different socioeconomic statuses. In upper Midwest metropolitan areas, significantly higher noise readings were reported as median income and housing value decreased (an indicator of socioeconomic status), which had a higher proportion of residents from minority groups. Yet, it's unclear if social factors in our local community affect noise levels and if noise levels can be measured by a validated and convenient method. Smartphone applications have been validated on older smartphones to monitor individual noise exposure. Therefore, the purpose was to measure noise using previously validated smartphone apps on recent smartphones, to determine if noise levels vary based on socioeconomic status, and gather customer experience data. Weighted and unweighted measurements (10min.) were collected with 2 apps (SoundMeter X and SPlnFFt) on an iPhone11 from 3 venues (grocery store, high school, hospital) in two locations in Tucson, AZ, U.S.A. that varied in socioeconomic status (i.e. median home value, South Tucson and Catalina Foothills between 4:30-5:30 pm). Measurements were repeated 3 times in each venue and location. Unweighted measurements were collected prior to collecting A-weighted measurements on both applications simultaneously. For the SPLnFFT application with weighted measurements: The noise intensity of low frequency noise (0-8Hz) was significantly higher in all three venues in South Tucson compared to Catalina Foothills. Yet, the noise intensity of high frequency noise (8-20Hz) at the hospital was significantly higher compared to Catalina Foothills. For the SoundMeterX application: The noise intensity for weighted and unweighted measurements at the grocery store and weighted measurements at the hospital were significantly higher in South Tucson compared to the Catalina foothills. Socioeconomic status affects noise levels in Tucson, Arizona with louder noise at venues in locations with lower socioeconomic status but the relationship appears to be influenced by frequency of the noise and venue.

Leah Habtamu

Chemistry at University of Texas, Austin

Mentored by Dr. Celina Valencia (Cancer Center)

Humans and Disease: Exploring the Impact of Climate Change on Global Health

ABSTRACT: Climate change is one of the most pressing issues civilization faces in the coming decades. Studies claim that people residing near vector-borne pathogen rich areas are at risk due to increases in transmission from surface-warming. A review of the article “Exotic Species and Autochthonous Parasites: Trichostrongylus Retortaeformis in Eastern Cottontail'' written by Gontero et al. (2020), supported this idea of increased spread through a study that examined how G. strigosum helminths showed an increase in force of infection and egg-shed rate over the course of 25 years. As these pathogens and parasites increase spread over time, people lacking immunocompetence will begin to come into contact with them- providing the basis for widespread fatal disease in these communities.

These pathogens are also expected to have increased spread as a result of extreme weather events, which is examined in the article “Climate Change and Human Health: Present and Future Risks”, written by McMichael et al. (2006). One consequence of climate change is excessive drought, or excessive rainfall- both of which can cause extended water storage and provide an environment for vector-borne disease to grow and thrive. Further research and changes in policy must be done to understand and combat climate change.

Jenna Hamilton

Forensic Science; Law at Duquesne University

Mentored by Jose Veleta, Doctoral Candidate (Chemistry & Biochemistry)

TBA

ABSTRACT: Frustrated Lewis Pairs originate from Lewis acids and bases with unneutralized reactivity from the steric repulsion between them. This allows for the ability able to break and form covalent bonds in very stable molecules at milder reaction conditions. As a result, frustrated Lewis pairs are being considered as a cheaper alternative for the conversion of greenhouse gases into human consumption. Within frustrated Lewis pairs, there are some limitations because Lewis acids are less versatile and stable due to perfluorinated alkyl/aryl boranes and alanes in comparison to Lewis bases. Mainly Lewis acidic carbon centers are considered scarce and limited to a select number of compounds. The carbenium ions are mainly air sensitive, highly oxophilic, and experience side reactivity, which can limit the use and stability the compounds have in wet solvents and limit their tolerance to many functional groups and reaction conditions in catalysis.

The use of heterocyclic fused carbenium analogues were found beneficial because they have more planar scaffold and a reduced steric hindrance at the central carbon. The heterocyclic fused carbenium that was found to have lewis acidic properties and is stable under water and oxygen conditions is called Trioxatriangulenium, or TOTA. TOTA, is water stable, fairly acidic, resistant to para-aryl nucleophilic attack and results in the formation of the Lewis acid-base covalent adduct. Overall, Trioxatrianguleniums (TOTA+) and sterically hindered phosphines, such as P(t Bu)3, can act as a frustrated Lewis pair. This allows for a possible cheaper alternative for the conversion of greenhouse gases for human consumption

Gaddy Lopez

Physiology at University of Arizona

Mentored by Patricia Ferrer, PA (Dermatology)

Immunity and Implants

ABSTRACT: The increasing use of breast implants for cosmetic or post-mastectomy reconstruction places breast implant illness and its associated immunological diseases as an emerging and compelling medical challenge. The purpose of this paper is to analyze the recent findings regarding silicone breast implants (SBIs) and autoimmune diseases. The proposed explanation of breast implant illness is that the silicon contaminants react individually or become with a reactive oxygen species that activates the innate and adaptive immune systems. The initiation of immune response by cytokine release or B cell activation and antibody production, creates a cascade of events which leads to an exaggerated immune response and ultimately leads to disease. Breast implants cause autoimmune issues due to the amount of Silicon, which disrupts immunological responses in the body. Breast implants cause autoimmune issues due to the amount of Silicon, which disrupts immunological responses in the body. Future Directions: The recent addition of fat grafting to the breast as a modality for soft-tissue augmentation presents a further tool in treatment of the explanted breast mound with a valid safety record. Important to perform a risk stratification of individuals with genetic predisposition through the detection of specific alleles of Human Leukocyte Antigen (HLA) to prevent vaccination or silicon implantation.

Desiree Miller

Environmental Science at University of Texas, El Paso

Mentored by Dr. Monica Ramirez-Andreotta (Environmental Science)

Participant Motivations and Outcomes in A Co-Created Citizen Science Project

ABSTRACT: Public participation in environmental research through citizen science presents an opportunity to increase the scale of research as well as engage communities in environmental Action. Accordingly, it is vital to understand the motivations of those who engage in participatory research in order to maximize beneficial outcomes. The aim of this study was to examine participant attitudes and learning outcomes in a co-created environmental health citizen science project. Data used for this study came from participant surveys that were completed at the end of the third and final year of the project. Survey responses were analyzed using NVivo qualitative data analysis software. Questions examined participant attitudes in the area of what motivated them to join and remain in the project, their relationship to science, and taking environmental action. Results found that common participant motivations included a desire to receive their personalized results as well as relationships with promotoras (community health workers). Many participants indicated that they had more respect for science after participating in the project. Approximately 70% of participants indicated that they felt responsible for taking Environmental action and 80% planned to take environmental action. These responses suggest that Participating in citizen science could engage community members in environmental stewardship as well as increase scientific literacy and public trust of scientific research. Personal relationships between participant and community health workers along with direct relevance of the project to the lives of the participants are important factors to consider for maintaining engagement among citizen scientists.

Ivana Murillo Rascon

Nutritional Sciences at University of Arizona

Mentored by Dr. Vanessa Da Silva (Nutritional Sciences)

Barriers to Dietary Changes in Participants in The Diabetes Prevention Program (DPP)

ABSTRACT: The Diabetes Prevention Program is a yearlong, CDC supported program to reduce the risk for type 2 diabetes (T2D). Diabetic participants are encouraged to have a 5% weight reduction and at least 150 minutes of physical activity to reduce the risk of T2D by 58% (71% if over the age of 60 years). The goal of this project aims to explore how one-on-one nutritional coaching might help identify barriers to dietary changes in this group lifestyle change intervention. A convenience sample of participants (n=4) were selected from a single ongoing DPP cohort. Individualized nutritional coaching consisted of reviewing dietary foodlogs based on the Joslin guidelines to decrease the risk of diabetes for high risk populations. Calorie estimation to promote weight loss of 1-2 pounds per week were suggested for each participant. Nutritional coaching was based upon the food preference of the participants. The intervention participants established SMART goals, attended 30 minute one-on-one zoom meetings weekly for four weeks, maintained weekly food logs, updated their weight status biweekly, and updated their goals based on their success to improve their eating habits.Within the 4 weeks of personal nutritional coaching, the program participants had an average decrease of BMI of 30.1 to 29.3, 4.5 pounds of weight loss, decrease of calorie intake, and increase of vegetable and fruit intake. Challenges that were encountered were barriers to self-efficacy for food preparation, lack of recipe adaptation, lack of familiarity with non-starchy vegetables, and lack of fruit as dessert. The action plan to overcome these barriers were to create culinary educational videos that included diabetes friendly recipes and basic knife handling skills. Program participants may benefit from nutritional one-on-one coaching to improve their eating habits and challenges should not be overlooked to overcome the obstacles. Weight loss is not a good food metric that reflects improved health because participants could be losing weight unsafely. It's important to discuss basic culinary education as it is just as important as nutrition education for participants to be able to apply their nutritional knowledge. In the future, we should expand the effectiveness of culinary education videos and one-on-one nutrition coaching, while continuing to provide nutritional education.

Jada Parker

Nutritional Sciences at University of Arizona

Mentored by Kristin Morrill, Doctoral Candidate (Nutritional Sciences)

Food Patterns Associated With Liver Steatosis Among U.S. Hispanics/Latinos

ABSTRACT: Liver cancer is a highly fatal cancer among Hispanic adults. A leading risk factor is non-alcoholic fatty liver Disease (NAFLD). Dietary intake has been found to be associated with an increased risk of these more aggressive states of liver disease within the NAFLD spectrum.

NAFLD progresses due to factors like obesity, diabetes, dyslipidemia. An increase of liver fat can lead to inflammation which reduces liver function due to constant liver cell repair, which can lead to scarring of the tissue. If this process continues, the liver can undergo cirrhosis and potential hepatocellular carcinoma, known as liver cancer. Certain dietary components are associated with an increased risk of liver fat an dan increased risk of NAFLD, for example, sugar sweetened beverages, foods containing fructose and processed foods. However, there is limited research looking at which food patterns are associated with increased risk of liver fat, specifically among Hispanic men and women in the US. The purpose of this study is to explore food patterns associated with liver fat among U.S. Hispanic adults.

Janet Rubalcava

Physiology; Medical Sciences at University of Arizona

Mentored by Dr. Celina Valencia (Cancer Center)

The Contribution Cellular Glutathione and the cGAS/STING Pathway Have During a Human Papilloma Virus Infection

ABSTRACT: The human papilloma virus is the most common sexually transmitted pathogen in the United States. 99% of cervical cancers and 5% of all human cancers in the world are caused by high-risk HPV. HPV16 is in the high-risk division and responsible for more than 50% of cervical cancers. HPV infection requires transport of the viral genome (vDNA) into the nucleus of basal keratinocytes. The virus is a small circular non-enveloped virus and contains a major capsid protein, L1, and a minor capsid, L2. After viral replication in differentiated basal keratinocytes, mature virions are in an oxidized state and attain this state with reduced free thiols found in cells. In the epithelial tissue a large intracellular pool of glutathione (GSH), an antioxidant, maintains homeostasis of redox reactions of cellular thiol and disulfide. Depletion of glutathione is efficient for prevention of post-Golgi trafficking and intranuclear delivery of HPV16. During initial infection, specifically for HPV16, the natural surveillance immune system response cGAS/STING pathway is inactive. Due to HPV's unique mitosis-dependent vesicular trafficking it can evade this pathway and the phosphorylation of IRF3. Phosphorylated IRF3 reduces cellular proliferation and is detrimental for the establishment of HPV16 infection. Premature membrane penetration of HPV using cationic lipids disrupted the vesicular membrane and activated cGAS/STING pathway, generating a pIRF3 response.

Zul Santiago

Nutritional Sciences at University of Arizona

Mentored by Angela Yung, RD (Cancer Center)

Implementation if an accelerometry data processing protocol to assess sleeping patterns in breast cancer survivors

ABSTRACT: Background: It is estimated that 40-50% of cancer cases including recurrences can be prevented with lifestyle modifications such as diet and physical activity. In addition, evidence has shown that different sleep components such as sleep quality, sleep duration or circadian rhythm can affect cancer risk. The Breast Cancer Weight Loss (BWEL A011401) study is a randomized control trial which tests a telephone-based weight loss program for early stage breast cancer survivors on recurrence prevention. To assess lifestyle behaviors, self-reported dietary and physical activity recalls are collected by trained research assistants via phone. In addition, participants wear an accelerometer device on their wrist for 7 days to objectively measure physical activity and sleep patterns. Objective: To determine the difference in sleep data output between two processes 1) automated sleep detection algorithm 2) automated sleep detection algorithm with an additional step in which automated sleep periods are compared to and adjusted based on participant-completed tracking sheets. Methods: Thirty random files at baseline were selected to be manually cleaned. Non-wear time algorithms were run within the ActiLife program to determine whether participants wore the device while sleeping. Then the Cole-Kripke algorithm was run to auto-detect sleep periods. The Cole-Kripke algorithm is based on the general healthy population with ages ranging from 35 to 65 years old. Each participant's auto-detected sleep periods were compared to participant-completed tracking sheets (sleep diaries) provided by each participant. If there was a discrepancy of greater than 3-4 hours, times from the sleep diaries were entered if they corresponded with the participant's sleep movement patterns on other days. Conclusion: Significant differences were found between automatically scored and manually cleaned data which highlights the importance of manually checking participant files for accuracy. For example, wake after sleep onset (WASO) was twice as high after cleaning, changing from a mean of 32.5 (pre) to 61.2 (post). In addition, every sleep variable analyzed had a p value of less than 0.05 indicating differences were statistically significant. As mentioned, it is important to manually check participant files against sleep journals and clean each participant's file to generate the most accurate variables to be used when looking at overall trends in the BWEL study

Ivan Sarabia

Kinesiology at New Mexico State University

Mentored by Dr. David Margolis (Orthopaedic Surgery)

“3D print design for multi-biomaterial bone scaffolds”

ABSTRACT: "Critical size bone defects present a clinical challenge. Current techniques such as allografts or autografts are the primary options to replace missing bone tissue but have their drawbacks as well. 3D printed bone scaffolds comprised of biomaterials may allow for regrowth of bone tissues and improve clinical outcomes. Biodegradable scaffolds embedded with adipose derived stem cell bio-inks may facilitate osteogenesis wherein the body can “close the gap”. Computerized design is the first step in the implementation of implantable multi-biomaterial bone scaffolds. Current automated slicing software is limited to simple print designs and cannot incorporate varying material temperatures and printhead positions. Manual gcode adjustments are required to develop viable multi-material prints that can be used to test scaffold models in vitro."

Julia Vega

Cellular and Molecular Biology at Western New Mexico State University

Mentored by Dr. John Konhilas (Physiology)

Sex Differences within the Ileum of High-Fat Diet Mice

ABSTRACT: High-Fat diets (HFD) have been shown to change the gut microbiome which is linked to higher risks of autoimmune disorders, cardiovascular disease, and obesity. In the gut, specifically the small intestine, there is a lining of cells present along the luminal surface of the tract. This is the gut epithelial or the epithelial barrier, which functions to separate inner and outer environments of the gut in order to maintain homeostasis. Present in the small intestine is the Ileum, which functions to absorb water and nutrients during the latter half of digestion. The Ileum contains gut epithelial cells, villi, and Peyer patches- all of which are influenced by the presence of a HFD. HFD changes in the gut can manifest as altered hormone secretion, a compromised epithelial barrier, and an increase in harmful bacteria. The prebiotic, oligofructose (OFS), has been shown to reduce energy intake and fat mass when supplied as a diet treatment for HFD. OFS will be implemented to offer an insight into how these conditions affect sexes separately. The aims of this study are to determine the sex differences of the gut epithelium in mouse ileum and to determine sex difference-effects of Oligofructose (OFS) on the gut epithelial barrier in mouse ileum. What was found was that sex differences in OFS response were observed in the Ileum; and no significant sex dependent morphologies were observed.

Kayla Zaldivar

Speech, Language, and Hearing Sciences at University of Arizona

Mentored by Dr. Elena Plante (Speech, Language, and Hearing Sciences)

Test-retest Reliability of the Structured Photographic Elicited Language Test fourth edition (SPELT-4)

ABSTRACT: Background: Clinicians must have access to a test's validity and reliability when determining what standardized tests they should use. Aims: The purpose of this research was to investigate the test-retest reliability of the Structured Photographic Elicited Language Test fourth edition (SPELT-4). Methods and Procedures: The SPELT-4 was administered to Developmental Language Disordered children aged 50-72 months. This study assessed the test-retest reliability of SPELT-4 using the raw scores from the first and second administration of the test. Results: The results indicate a strong test-retest reliability. Conclusion: This provides clinicians with the reliability of SPELT-4. Clinicians can assume that the score is not due to an error and the child would receive a similar score if they were retested. Stable scores are crucial when determining if a child has typical or impaired language.