

Summer Research Institute (SRI)

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SUMMER RESEARCH INSTITUTE



LYLE BECENTI

Investigating the Overexpression of the IDH3 Protein in Drosophila Melanogaster Model of Amyotrophic Lateral Sclerosis (ALS)

Northern Arizona University, Biomedical Science

Mentor: Daniela Zarnescu, Molecular and Cellular Biology

Abstract

Investigating the Overexpression of the IDH3 Protein in Drosophila Melanogaster Model of Amyotrophic Lateral Sclerosis (ALS). Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that affects the nerve cells of the brain and spinal cord. It is an incurable condition that requires further investigation of the contributing genetic factors to its development. Because ALS is a progressive loss of structural function of neurons, we utilize Drosophila melanogaster (fruit fly) models within our research. The Drosophila models have an excellent genetic background and its fly relatives are related to 60-70% of human disease genes. In our attempt to understand ALS, we investigate the isocitrate dehydrogenase [NAD] regulatory subunit 3 (IDH3) protein and its association to the TAR DNA-binding protein 43 kDa (TDP-43). TDP-43 is not only commonly associated with ALS, but it is believed to repress gene expression by sequestering mRNA, which decreases protein levels. Therefore, the goal of our study is to find physiologically relevant targets of TDP-43 and our leading candidate is the IDH3 protein. The RNA of IDH3 is highly correlated with TDP-43, which was verified from the expression and metabolomic data. This is significant, especially since the IDH gene has not been addressed in the context of ALS and the lack of IDH is believed to cause neurodegeneration. So, using the qPCR protocol, larval turning, and dissecting larval ganglion, we try to better understand ALS and identify relevant targets of TDP-43 sequestration that lead to the ALS phenotype. Particularly, we attempt to understand if the overexpression of IDH3 in fruit fly model of ALS improve survivability and the larval turning speed.



ONNA BEGAY

Foundations for Art-Based Group Therapy with Homeless Women

The University of Arizona, Public Health and American Indian Studies

Mentor: Rosi Andrade, Southwest Institute for Research on Women

Abstract

Foundations for Art Based Group Therapy with Homeless Women
It is difficult to respond to the needs of homeless women when there is little understanding or information about the state of homeless women. Previous research has noted that homeless women have experiences that are unique to them in terms of how they became homeless and what traumas result from the past as well as from current homelessness. This paper explores how homeless women have different pasts that require individual care. Homelessness is multifaceted with many varying degrees. When working with a vulnerable population, it is important to both challenge the

dependability of current data and identify gender-specific needs that inform policy. Women of diverse backgrounds and different ages were observed at Sister Jose Women’s Center (SJWC) to be able to establish a trusted presence in the center . A researcher from The University of Arizona completed private community assessments with 50 women while I observed. This research is the beginning of a larger study that consist of understanding the different backgrounds of women and establishing a relationship. We have gained insight on the atmosphere of the center. This study is a continuous and will lead into the creation of art -based therapy groups for women that contain literature readings and creative writing.



ROSLYN CURRY

Truncation of the Coiled-coil Domain of Soluble Guanylyl Cyclase and Its Effect on Carbon Monoxide Binding

The University of Arizona, Biology

Mentor: William Montfort, Chemistry and Biochemistry

Abstract

The protein soluble guanylyl cyclase (sGC) is the primary receptor for nitric oxide and plays a critical role in blood pressure regulation, wound healing, and memory formation. sGC is also an important mediator in tumor vascularization, which enables cancer growth and metastasis. Knowing the structure of the protein will help in understanding how sGC functions and in designing compounds/drugs that control sGC activity. sGC is a multidimensional heterodimeric protein with a single ferrous heme group, but the structure of the protein is still unknown. To elucidate this structure, we experimented with truncation of several domains of sGC, since the full length protein is very unstable. Multistep protein purification and dynamic light - scattering experiments were conducted to test for homogeneity of the protein and will be followed by crystallization experiments. Screening for crystallization of several mutants and fragments of sGC should result in microcrystals under various conditions which can be further optimized to grow larger crystals suitable for X ray crystallography.



MICHAELA DUARTE

Against Epistocracy: A Critique of Brennan’s Conception of Competent Voters

The University of Arizona, Philosophy, Politics, Economics, and Law

Mentor: Suzanne Dovi, School of Government and Public Policy

Abstract

This paper analyzes and critiques an argument proposed by Jason Brennan against the efficaciousness of democracy. Brennan argues against a defense of democracy that he calls “Democratic Triumphalism,” by arguing that democracy may produce bad outcomes, if the voting citizenry are generally uninformed or have bad epistemic habits. Brennan further argues that only voters who are competent ought to be granted voting rights. This sort of political system is broadly referred to as epistocracy. Using data from fields such as political science and political psychology, this paper answers two questions. The first of these questions is, “do competent voters, according to Brennan’s definition, actually exist?” The second

question is, “would Brennan’s epistocracy produce better outcomes than democracy?” This paper holds that Brennan’s conception of a competent voter is too demanding. Furthermore, this paper proposes that Brennan’s epistocracy would not be more efficacious than democracy.



ADAM FERNANDEZ

The Effects of Fungal Symbionts on Zea Mays Germination

Northern Arizona University, Biomedical Science

Mentor: Betsy Arnold, Plant Sciences

Abstract

Agricultural crops are always seeking improvement in productivity, yield, and reduction of raw materials for farming. Some fungal symbionts can mediate the overall health and success rates of other organisms, Worchel and Giauque’s work in fungal plant relations and water uptake supports this (2012). A two-part study was conducted, first determining if fungal life stage was important in seed inoculation success rates followed by a study to see if fungal strains can help increase seed germination. The first trial was performed to measure growth rate and germination, as well as successful rate of inoculations of agricultural soil samples of fungi F1 and F2. Each fungal sample was inoculated onto thirty sterilized Country Gentleman seeds of Zea mays at either the sporulating or mycelial life stage. Inoculations with all growth types were successful, however none of the seeds underwent germination. The second trial included Glass Gem popcorn, in addition to the Country Gentleman Sweetcorn. In this new round of experimentation, samples were exposed to heat sterilization, fungal inoculation or both. The remaining seeds were divided into groups being heat sterilized or only surface sterilized, separated by fungal inoculant and seed type. Out of 360 total seeds two successful germinations occurred, although they did not grow alongside the fungal inoculants. Several other fungal and bacterial species were able to survive the seed sterilization treatments. These unknown microbes were isolated for further examinations in PCR and DNA sequencing, results are pending.



NATHAN FIER

Finite Difference Solutions to the SPn Equation

The University of Arizona, Mechanical Engineering

Mentor: Barry Ganapol, Aerospace and Mechanical Engineering

Abstract

Finite Difference Solutions to the Even Parity Transport Equation in Slab Geometry
The purpose of the present study was to derive numerical solutions for the transport equation using a central finite difference scheme, to apply techniques to accelerate convergence, and to verify the final results in one dimension. Followed by expanding the algorithm to address two and three dimensional problems. The application of the even parity transport equation allowed for the simplification of the geometry due to the symmetry between angles. Both Dirichlet and Neumann boundary conditions (Vacuum and Reflecting) were considered. Acceleration towards convergence was achieved through the derivation of an error term which took the form of the diffusion

equation. The results of this study were materialized in a computer program written in Matlab, then verified using a symmetry test, trend test, and comparison test. This study was also successfully expanded the problem into two and three dimensional models. Further objectives that could be addressed in the future include applying acceleration techniques to both the two and three dimensional models as well as verification of the two and three dimensional problems.



KYLE HARVEY

What Is Making a Difference? The Teacher- Student Relationship and Development of College-Going Aspirations for Native American Students

The University of Arizona, Literacy, Learning, and Leadership

Mentor: Gary Rhoades, Higher Education

Abstract

The purpose of this research is to analyze the relationships between pre-service teacher education, culturally responsive schooling, the teacher -student relationship, and the development of college aspiration among Native American and Alaskan Native (NAAN) students. In identifying the gaps in these relationships, this paper will help inform pre-service teacher training programs, so that teachers are better prepared to serve within multicultural settings. With the use of sharing circles and semi-structured interviews, I will use the collection of feedback from my participants to answer my research question. This research is still in progress.



GENESIS HERNANDEZ

Applying the Principles of Learning Theory as a Spelling Instruction Strategy

The University of Arizona, Speech and Language, Linguistics

Mentor: Mary Alt, Speech, Language, and Hearing Sciences

Abstract

Despite the efforts of educators and literacy -based organizations, limited literacy levels effects 1 out of 5 adults in the United States. Given that adequate reading and writing skills are required in most aspects of daily life, it is imperative to find evidence -based practices that can improve literacy instruction. For decades, scientists in the field of cognitive science have been reporting on how individuals learn implicitly, or without effort. Despite these robust findings, learning theory has yet to be applied to pedagogy. In this pilot study, the principles of learning theory will be merged with learning theory to better the spelling performance of third grade students attending an afterschool program. Students will be taught spelling lists using either a 5 -minute PowerPoint -based training or a 5-minute session using manual practice. Spelling lists will be comprised of words of varying difficulty, established by the orthographic transparency of each word that will be counterbalanced for each condition. The spelling lists will be taught over the course of several weeks in 4 training sessions. Participants will be regularly tested on their spelling to monitor their progress. After completion of the pilot, the study will be extended to include fourth, fifth and sixth graders. Though the experiment has yet to be conducted, the researchers expect to see improvement in spelling performance for the participants.



MATTHEW LYSKAWA

On Higher Order Causal Explanations

University of Rochester, Philosophy

Mentor: Joseph Tolliver, Philosophy

Abstract

Frank Jackson and Philip Pettit (1990) identify two sorts of causal explanations: Lower order and higher order. Lower order causal explanations, on the one hand, are explanations that explain the production of an explanandum event by referring to microphysical particles and their properties. Higher order explanations, on the other hand, explain an explanandum event by referring to epiphenomenal properties which are realized by microphysical properties. Jackson and Pettit(1990) argue that higher order explanations may provide information about how the history of an event might have gone. I argue that higher order causal explanations do not provide information about how the history of an explanandum event might have gone because events are modally fragile . The notion of modal fragility can be summed up thusly: If an event can differ in some respects and remain numerically the same event it is not modally fragile if the event cannot differ in some respects and remain numerically the same event, it is modally fragile. Jackson and Pettit (1990) assume events are not modally fragile and their claim that higher order causal explanations provide modal information about events rest on this assumption. I argue events are modally fragile because if they were not the Principle of Indiscernibility of Identicals (Forrest 2010) would be false. Because this principle is of such metaphysical importance, the idea that events are not modally fragile should be rejected. But the claim that higher order explanations provide modal information rest on the assumption that events are not modally fragile, the modal fragility of events should be rejected.



EDGAR MARRUFO

Calibrating the Mass-Correlation Function Relationship for Galaxy Clusters

Northern Arizona University, Physics and Astronomy

Mentor: Eduardo Rozo, Physics

Abstract

Developing methodologies for calculating the mass of groups or clusters of galaxies is fundamental for the study of dark energy, which property of accelerating universe expansion is known, yet dark energy is not particularly well understood. This study focuses on calibrating the mass-correlation function relationship of galaxy clusters by computing the bias, which represents the calibration factor for the mass of clusters. The correlation function indicates how galaxy clusters clump together; therefore, the clumpier galaxy clusters are, the more matter there is. Constraining the mass from correlation functions implicates the implementation of numerical simulations to process simulated data. The outcome of this study was a calibration factor as a function of radius. The bias (calibration factor) serves as a reference point for the identification of unknown masses from galaxy cluster pairs with known three dimensional coordinates. Further research is necessary to apply this calibration to real data and test its efficacy



CHLOE MORENO

Nationalism and Academic Freedom in the Present Day

University of Notre Dame, Political Science and Gender Studies

Mentor: Anna Ochoa O'Leary, Mexican American Studies

Abstract

The following research paper investigates present day concerns over academic freedom in institutions of higher education through the context of rising nationalism in the United States. The paper first reviews cross-disciplinary literature that discusses the current, widely accepted definition of academic freedom, its relationship to the First Amendment of the United States Constitution, and how it is applied throughout colleges and universities. The literature also identifies trends in nationalism at different points in United States history, the history of academic freedom rights violations in institutions of higher education, and the ways that the courts have previously ruled on these cases. The paper will then explain the research methodologies of a pilot survey that was dispersed by Dr. Anna Ochoa O'Leary. The purpose of this survey was to gauge the institutional climate and attitudes of a cross section of University of Arizona professors. Because of the sample size, the results are inconclusive, but indicate areas where further research may be warranted. The preliminary data can be used to direct the final survey in a way that will lead a broader understanding of the issues at hand.



LUCIA MOSQUERIA

Total Body Fat and Abdominal Obesity are Associated with Increased Subclinical Chronic Inflammation in Hispanic Girls

The University of Arizona, Nutritional Science

Mentor: Jennifer Bea, Medicine

Abstract

Over twenty-two percent of Latino children aged 2-19 are obese, and rates of severe obesity are higher among Latino compared with White children. The number one killer of Latinos is cardiovascular disease, which is strongly obesity-related. C-reactive Protein (CRP) has been shown to promote vascular inflammation and endothelial dysfunction; therefore, elevated CRP values suggest future cardiovascular risk even in healthy subjects. The purpose of the current study was to assess the association of body composition with CRP values in Hispanic girls aged 9-12. Secondly, we compare anthropometric estimates of regional and total body composition to DXA and pQCT derived measures of corresponding regional and total body composition for the prediction of CRP. The present study included completion of questionnaires by participants, as well as evaluation of fasting blood samples, anthropometric measures, and body composition measures (DXA and pQCT) in a total of 226 Hispanic girls aged 9 to 12 years. Baseline age was 10.71 ± 1.08 yrs. WC, WtHR, total body fat and CRP values were increased in obese and overweight individuals. Total body fat (%) and lean mass (%) were significantly associated with CRP. After adjusting for potential confounders, WtHR was shown to be the best predictor for elevated CRP values in Hispanic girls. In conclusion, abdominal obesity is associated with increased CRP values in Hispanic girls. WtHR is the best predictor for assessing subclinical chronic inflammation. After controlling for potential covariates, gynoid fat was a

better predictor than android fat for CRP values.



MARGARITA NUNEZ ARROYO

Kate Del Castillo as a Mujer Brava in Ingovernable and La Reina Del Sur

University of Kansas, Journalism

Mentor: Jeannine Relly, Journalism

Abstract

In film and media today there is a general notion of giving Latina actresses roles that follow stereotypes that either hypersexualize them or make them submissive beings (Molina-Guzmán 2010). Kate Del Castillo is a Latina actress who is most popularly known for her role as Teresa Mendoza in the narcotelenovela La Reina del Sur (Vermeulen, 2016). Castillo also starred in Netflix's TV show Ingovernable which follows Emilia Urquiza as she becomes a fugitive for the murder of Mexico's president who is her husband. Castillo through her personal life and roles has demonstrated being a *mujer brava*. This scholarship examines how the characters in these two different mediums of television implement resistance to patriarchy. Through the use of theory of the flesh and gender performance this study focuses on the concepts of trauma, resistance and resilience to describe the *mujer brava*. Gender performance is analyzed in this scholarship as a form of agency to perform characters that are non-submissive and exerting their power in a male dominated world. Novelas are central to the dynamic of Latinx families, they not only impose the *chisme* of the week but also the norms of gender and expectation of individuals in the family (Kjeldgard, 2010). Thus, this scholarship is an analysis on the significance of TV shows and novelas and how such characters as Teresa Mendoza and Emilia Urquiza are creating a new female character, the *mujer brava*



MIGUEL OSORIO

Design of a Novel Rectal Tonometer Artifact to Monitor Neurophysiological Status during Neural Tube Surgeries

The University of Arizona, Mechanical Engineering

Mentor: Eniko Enikov, Aerospace and Mechanical Engineering

Abstract

Neural tube defects are a heterogeneous group of congenital malformations resulting from defective closure of the neural tube during the developmental stage in the embryo. Consequences vary in severity, ranging from chronic incontinence to acute paralysis and stillbirth. In order to treat their onsets and avoid further neuronal deterioration, intraoperative methods have been developed to monitor the neurophysiological status of the spinal cord. However, some medical institutions do not possess the necessary equipment and techniques to perform these complex operations successfully. Therefore, this paper presents the development of a cost-effective, high-performance neurophysiological monitoring device to be used during neural tube -particularly spinal cord-operations. The artifact will evaluate sphincter pressure variations, for they provide insightful neurophysiological information, and display real-time feedback to surgeons so that they can proceed with better

judgments. A design model was developed and tested under specified pressure ranges intended to simulate the neonates' sphincter function and key characteristics. To convert input tones to output voltages, a high-accuracy pressure sensor circuit was elaborated and the recorded information was imported to LabView software. Furthermore, a step-rate and repeatability tests were used to analyze the performance and reliability of the model. Interestingly, the device was able to gather pressure far greater and lower than anticipated. It was extremely sensitive to fluctuations and could perform repeatedly without further calibrations. Altogether, the investigations indicate that the design model is able to outperform current monitoring techniques and is sufficiently affordable to become the standard procedure during NTD operations.



KRISTEN TALLIS

Dietary Quality, Physical Activity, and Treatment Symptoms in Ovarian Cancer Survivors

Northern Arizona University, Exercise Science

Mentor: Cynthia Thomson, Health Promotions Science

Abstract

Research in ovarian cancer (OC) rarely includes analysis of the associations between dietary quality, physical activity and cancer treatment-related symptoms. Epidemiological and observational studies have recognized physical activity, diet quality, and cancer treatment symptoms as modifiable behaviors associated with OC survivorship and quality of life (QOL). The purpose of the research is to assess the relationships between treatment-related symptoms and lifestyle behaviors in order to provide preliminary data to further investigate symptom management and its impact on adherence to diet and physical activity guidance in OC survivors. Participant data were collected from the Lifestyle Intervention for Ovarian Cancer Enhanced Survival (LIVES) study (n=201) and were statistically evaluated based on Healthy Eating Index (HEI) Score, Actigraph accelerometer data, and MD Anderson Symptoms Score (MDASI). There were no significant associations between any symptom and dietary HEI score or symptoms and PA. The inverse relationship between abdominal pain and HEI score was borderline significant (p=0.10). Higher sedentary activity (SA) and lower light physical activity (LPA) trended toward significance among participants reporting greater fatigue as was SA in participants reporting greater distress. Also, approaching significance (p <0.1) was participants' reporting of drowsy sleep symptoms and lower vigorous PA in comparison to women who do not report drowsy/sleepy symptoms. Overall the majority of OC survivors reported at least one symptom, with numbness/tingling, fatigue, and memory problems being the most frequently reported symptoms. Women had HEI scores consistent with adult population estimates and low reported moderate-vigorous PA (MVPA).



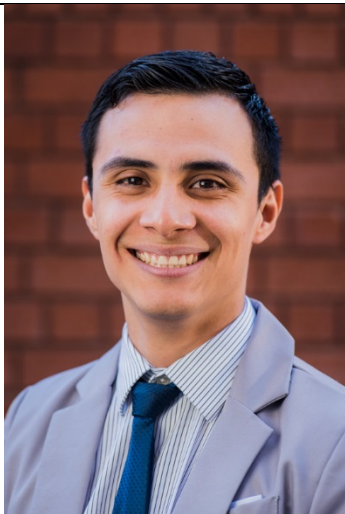
BREANNA TEETERS

Organophosphate and Pyrethroid Pesticide Exposure Among Residential and Agricultural Employee Housing in Yuma County, Arizona

The University of Arizona, Public Health

Abstract

Mentor: Paloma Beamer and Melissa Furlong, Community, Environment and Policy
Pesticides are prominent chemical pollutants in agricultural communities. The possible health effects that can be developed through chronic exposure are of significant concern in Yuma County, Arizona. This study will determine the percentage of agricultural employees and their residence’s exposure to pesticides in comparison to the percent of Yuma County residents who experience the same exposure. Results show that agricultural employee residences are more likely to experience pesticide exposure although twenty-five percent of Yuma residents experience exposure at all times as well. For both groups pyrethroid pesticide exposure is experienced at a higher level than organophosphate (OP) pesticides or OP and pyrethroid pesticide exposure. Previous studies show that pyrethroid pesticide exposure is associated with the development of certain neural deficits, specifically in the development of negative behavioral action in children. Chronic pesticide exposure has been presented as a common occurrence in Yuma County as a whole and needs to be considered as a serious hazard to agricultural workers as well as Yuma County residents.



EDGAR VILLAVICENCIO

Perspectives of Hispanic Male’s Participation in a Gender- and Culturally-Sensitive Weight Loss Intervention

The University of Arizona, Public Health

Mentor: David Garcia, Health Promotion Sciences

Abstract

It has been stated that in the United States Hispanic males possess the highest prevalence of being obese or overweight, yet, limited research has explored weight-related perspectives in conjunction with implementing gender-and culturally-sensitive concepts into lifestyle interventions for Hispanic men. The purpose of this study is to examine the perspectives of Hispanic males after completing a recent gender-and culturally-sensitive weight-loss intervention. This qualitative study will help to determine the program’s acceptability to refine approaches for future weight-loss management interventions in this specific population. The 23 exit interviews examined in this qualitative analysis were with participants who have recently completed the ANIMO (an ongoing weight-loss management intervention) trial. Participants were overweight/obese Hispanic males residing in Tucson, Arizona. An inductive data process was used by the research team to construct preliminary coding in broad categories such as a) participants’ progress/performance, b) motivation, c) family support/effects, d) approaches, and e) recruitment strategies for the ANIMO weight management intervention. Thus far, the qualitative work has shown significant acceptability and effectiveness of the ANIMO study. Concrete weight-loss results were noticed on the participants’ behalf. The gender-and culturally-sensitive approaches appear to have been successful as a significant portion of the participants identified that methodologies directed to Hispanics and Hispanic males specifically motivated them to change their behaviors and weight-loss management efforts and objectives. This study

Villavicencio2 will be completed and published towards the end of 2017 and will address a critical gap by making qualitative contributions to future gender- and culturally-sensitive weight-loss management efforts with Hispanic males.



DA'MERE WILSON

Planning For Two: The Caregiver As The Unacknowledged Patient During End Of Life Care
St. John's University, Psychology
Mentor: Mary-Frances O'Connor, Psychology

Abstract

The task of recruiting participants into bereavement research studies usually presents an abundance of challenges and barriers for research teams due to the particular vulnerability of this population. Traditional methods of recruitment are met with ethical and moral barriers when applied to a bereaved population since they are considered to be at heightened risk to be burdened when participating in research. The current study sought to understand the efficacy of different methods on recruiting bereaved adults. Specific aims were to assess the associations between 1) gender 2) recruitment method and 3) participation rates in order to examine which method was more efficacious. Participant data from five different studies (n= 344) in the GLASS lab were compiled into Redcap (a secure online database) including demographic and loss-related information as well as method of recruitment and study enrollment. Descriptive statistics were calculated to investigate the research question. Obituary mailings yielded the highest enrollment rate (58.2%) for men and women. All other methods combined only accounted for 41.8% of participant recruitment. Far more women (n= 279) were recruited than men (n=92), but when assessed for attrition 37.7% of women dropped from at least one study compared to only 23% of men. The results suggest that although more women were recruited for these studies, more of the men, that were assessed, were sustained through a study's completion. It is also apparent that obituary mailings are an effective tool to not only recruit participants, but to subsequently enroll those recruited into bereavement studies.