



THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

Undergraduate Research Opportunities Consortium



UROC

Abstract Review

August 2015

UROC: Undergraduate Research Opportunities Consortium 2015



Minority Health Disparities

Executive Director: Andrew Carnie, PhD

Program Director: Stephanie Adamson

Program Co-Director: Holly Lopez

MHD, funded primarily by UA, focuses on health issues that affect minority communities in a disproportionate manner. Open to junior or senior biomedical majors interested in continuing their education at the PhD level, MHD accepts students from other universities as funding is available.

MARIA ABIERO

MINORITY HEALTH DISPARITIES

MHD



UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. HEIDI BROWN

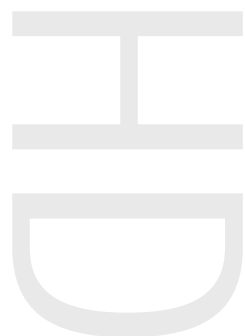
ASSESSING THE IMPACT OF BARRIERS ON THE LOCATION OF POSTNATAL VISITS: A CROSS-SECTIONAL ANALYSIS USING THE KENYAN DEMOGRAPHIC HEALTH SURVEY

ABSTRACT: Ensuring an infant's initial postnatal check-up is completed in a healthcare facility with skilled professionals is crucial for healthy development. This study examines what the association is between barriers to birth location and where a newborn's first check-up will be. The population of focus within the study is women of childbearing age in Kenya. The biostatistical analysis uses survey data extracted from the Kenyan Demographic and Health Survey (KDHS). A logistic regression model is used for indicating level of association between the reasons why women did not deliver in a healthcare facility and whether their lastborn had their first check-up at home or in a hospital. Results of the study indicated no association between the reasons why women did not deliver in a healthcare setting and whether their lastborn had their initial postnatal check-up in a hospital or at home. All 95% confidence intervals for the odds ratios contained 1 indicating no association between the barriers and the location of a newborn's first checkup. Implications of these findings indicate that any barriers women faced with respect to the location they gave birth (at or not at a health facility) were not significantly associated with where their newborn had its first check-up.

NATHALIE ANGEЛИQUE

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PI: DR. TODD W. VANDERAH

A ROLE FOR NRF2 IN THE REGULATION OF SYSTEM XC- IN A MURINE MODEL OF CANCER-INDUCED BONE PAIN

ABSTRACT: Many advanced staged cancer patients suffer from bone cancer pain. Unfortunately, mechanisms contributing to cancer-induced bone pain (CIBP) are unknown, and currently available analgesic agents do not offer satisfactory pain relief and result in many unwanted side effects. Development of pharmaceuticals that may relieve this devastating pain greatly depends on further understanding of cancer-bone pathophysiology. It has been previously shown that glutamate released from tumor cells contributes to CIBP. Tumor cells release glutamate via the cysteine/glutamate antiporter system xc-: a transporter that is a potential analgesic target in CIBP. The bone-tumor microenvironment results in a significant increase in reactive oxygen/nitrogen species. Hence, we hypothesized that increases in the reactive nitrogen species peroxynitrite up-regulate system xc- via activation of the transcription factor Nuclear factor (erythroid-derived 2)-like 2 (Nrf2), resulting in an increase in extracellular glutamate and pain. Using a mouse model of CIBP, we found increased expression of both system xc- and Nrf2 in the bone-tumor microenvironment. Preliminary evidence from in vitro experiments with tumor cells suggests that inducers of system xc- expression also activate Nrf2. Both the prototypical Nrf2 activator hydrogen peroxide and the peroxynitrite donating compound SIN-1 lead to increased Nrf2 protein level and nuclear translocation, two indicators of increased Nrf2 activation. These studies are the first to demonstrate how peroxynitrite regulates system xc- in tumor cells. Further research includes incorporating Nrf2 inhibitors to block SIN-1-induced increases in system xc- functional expression with hopes of discovering a novel analgesic target to aid in patients with CIBP.

KAREN BELTRAN

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PI: DR. KAREN HERBST

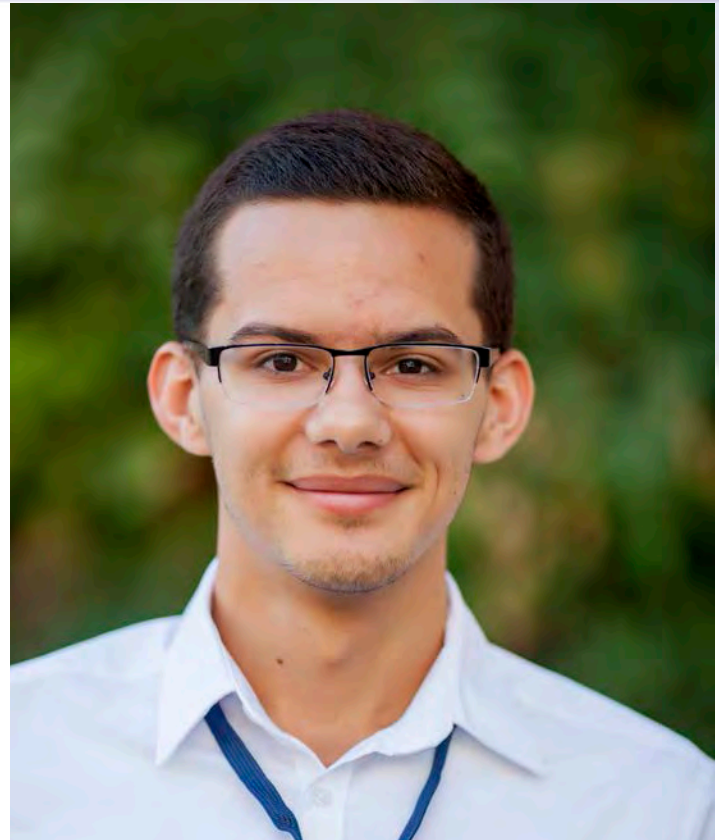
EVALUATION OF HYPERMOBILITY AND METABOLIC DISORDERS IN WOMEN WITH LIPEDEMA

ABSTRACT: There are two painful adipose tissue disorders (ATDs), lipedema and Dercum's disease. The subcutaneous adipose tissue (SAT) in these ATDs interestingly is not responsive to diet, exercise or even bariatric surgery. Lipedema SAT is located primarily in a gynoid distributions whereas Dercum's SAT can occur anywhere on the body. The etiology of these disorders is not known. Clinical examination of people with these ATDs suggests that many have Ehlers-Danlos syndrome hypermobility type (EDS-HT), where loss of elasticity due to changes in connective tissue occur. Interestingly, while a majority of people with these ATDs are obese, few have diabetes. Our hypothesis is that EDS-HT reduces elasticity resulting in a large excess of gynoid tissue, which is protective against diabetes. Our chart review consisted of evaluating 300 patients in Dr. Herbst's clinic at Banner University Medical Center that were diagnosed with lipedema or Dercum's disease. The data collected consisted of the age, sex, medical and surgical history, family history with ATDs, treatment recommendations, review of systems, physical exam consisting of fat location and Beighton Criteria for evaluation of EDS-HT. The data analyzed supported the hypothesis that an obese population (38.605 ± 12.277) of women with lipedema had higher rates of EDS-HT ($47.5 \pm 0.5006\%$) and lower rates of diabetes ($6.1 \pm 0.2407\%$). People with Dercum's disease had slightly higher rates of diabetes ($15.9 \pm 0.3682\%$) and lower rates of hypermobility ($22.3 \pm 0.4188\%$). The majority of patients with diabetes in our population did not exhibit EDS-HT. EDS-HT may promote the development of gynoid fat protecting against the development of diabetes.

KYLE DAVID GOBLE

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PI: DR. YVES LUSSIER

CHARACTERIZING DISPARATE BREAST CANCER PHENOTYPES IN HISPANIC WOMEN: A FOUNDATION FOR ASSIGNING OLIGORECURRENCE VS. POLYMETASTASIS

ABSTRACT: Women's breast cancer is widely recognized as exhibiting significant phenotypic variation from patient to patient. This is problematic when conventional treatment modalities are not applicable to patients with such varied disease expression. Oligometastasis (OM), an intermediary state of cancer metastasis defined by limited or isolated metastatic sites (five or fewer to distant organs), further complicates treatment; less invasive and more focused treatments have been shown to be effective for OM. The phenotypic variability combined with probable differential types of response to certain diseases calls for precision medicine. This study involved a characterization of breast cancer phenotypes in a population of Hispanic women. A set of 137 surgical pathology reports was analyzed for relevant breast cancer phenotype data, including primary tumor laterality, size, hormone receptor status, lymph node involvement, histological grade, and others. The majority of patients displayed estrogen and progesterone positive and Her2/neu negative phenotypes as well as intermediate to high histological grades. Additionally, unfavorable prognostic factors were correlated with other unfavorable prognostic factors. The results of this study demonstrate the variability of breast cancer phenotypes expected in the population even among a more homogenous ethnic population. This study also provides the foundation for the future elucidation of candidate experimental and control samples of OM patients for biomolecular marker studies with the goal of finding Hispanic-specific markers for OM breast cancer.

LAURA CHRISTINE HACKER

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PI: DR. JEFFREY FRELINGER

EXAMINING EFFECTS OF THE SALMONELLA TWO-COMPONENT SYSTEM ON LATE-STAGE TRAFFICKING IN MACROPHAGES

ABSTRACT: Many pathogens have the ability to modulate the host response to further pathogenesis, one such bacteria is Salmonella. Salmonella is a Gram-negative bacteria that can infect the host intestines, blood, and in severe cases cause death. The bacterium is a major problem for today's food industry, causing many in the population to become ill through contaminated food. Better understanding of the bacterium and how it manipulates host cells can provide a basis for a rationally designed attenuated vaccine. Using two strains, wild-type (WT) Salmonella, and Salmonella PhoPQ deletion mutant (Δ phoPQ) we examined the effects of this Two-Component System on Salmonella growth and pathogenesis. Through microscopy we evaluated Salmonella vacuolar escape and the trafficking of the bacterium through J774 macrophages. It is hypothesized that while WT Salmonella is able to escape from lysosomes, identified by lysosome-associated membrane protein 1 (LAMP1), Δ phoPQ can not escape and will be contained in LAMP1+ vesicles.

FERNANDO IVICH

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PI: DR. NICHOLAS A. DELAMERE

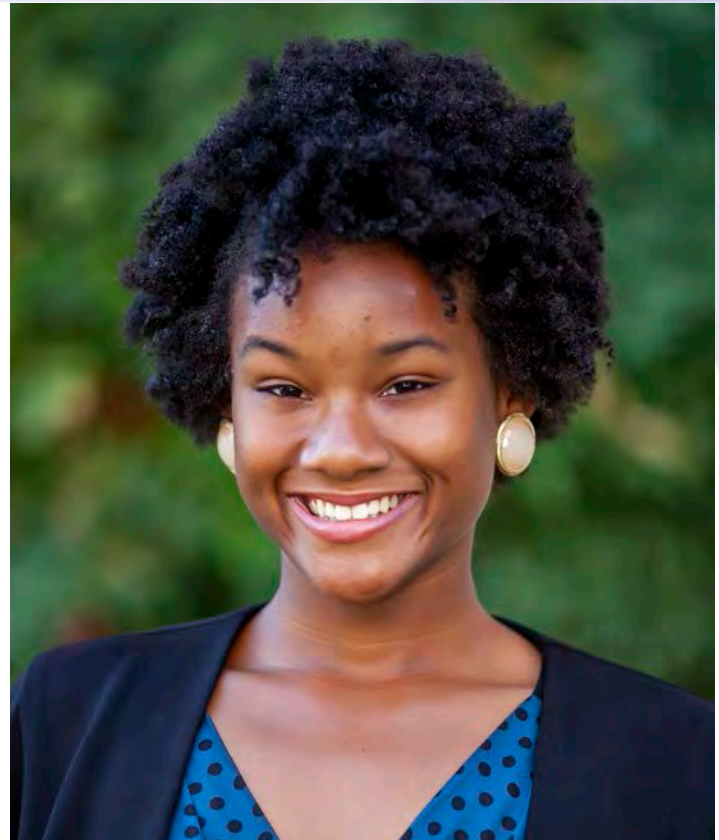
LOCALIZATION AND DISTRIBUTION OF TRPV4 ON THE LENS EPITHELIUM

ABSTRACT: Early studies showed exposure of intact lenses to hyposmotic solution triggers a number of cellular events such as opening of hemichannels, ATP release, increase in cellular cyclic AMP content, activation of Src Family Kinase and Na-K-ATPase, all of which are initiated and dependent on TRPV4 activation. TRPV4 is an osmo-and-mechanosensitive nonselective cation channel which when opened (activated) allows Ca^{2+} into the cells from the extracellular space. Western blot analysis shows presence of this protein in the epithelium. The objective of the present study is to localize TRPV4 on the epithelium and determine its distribution in the different regions. Whole rat eyes and isolated lenses are used for this study. Isolation of lenses was done according to published method from this lab. Eyes or lenses are fixed and paraffin sections prepared and subjected to confocal immunohistochemistry study. Whole rat eye paraffin sections show TRPV-4 staining on the lens epithelium as well as on the nonpigmented ciliary epithelium. There is some nonspecific staining in the surrounding tissues including equatorial fibers. Diffused nonspecific staining prevented drawing conclusion on whether the protein is located on the basolateral or apical membrane as well as finding its distribution pattern. In the future we will use a different primary and secondary antibodies. This suggests that rat lens epithelium appears to express TRPV4 protein on the membrane.

JADA K. JONES

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ALABAMA STATE UNIVERSITY

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PI: DR. SYDNEY A. RICE

ASSESSING THE USE OF IPADS IN THE HOME FOR CHILDREN WITH AUTISM

ABSTRACT: Autism Spectrum Disorder (ASD) is a neurodevelopmental disability that can result in social, emotional and communication impairments. Children with ASD can also experience sensory and fine motor difficulties. Because interacting with people can be challenging, some children with ASD prefer to use technology. Previous research demonstrates the iPad is useful in educational and therapeutic environments. This qualitative study assesses effectiveness of iPad use in the home for families of children with ASD through semi-structured interviews comparing information from families who have used an iPad for at least one year and those who had used an iPad for 4 weeks. Preliminary findings demonstrate differences between experienced and new iPad users in the perception of the iPad's utility; more experienced users viewed the iPad as just another useful tool. Both groups demonstrated positive experiences with the iPad when parents were less permissive. Families of children with behavioral problems found the iPad provided them with some respite as their child required less supervision when using the iPad. All parents described a need for more customizable parental or the inclusion of shut off timers to provide them with more automated enforcement of iPad use. Lastly, parents of nonverbal children found the iPad facilitated communication of needs, wants, and emotions. Parents of verbal children reported the tracing feature of the touch screen made homework easier because they could avoid handwriting. This study found that iPad has a function in the home beyond a reward mechanism. Customizable controls would help families manage home use more effectively.

AMANDA KOIKI

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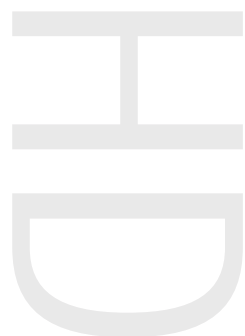
PI: DR. BIJAN NAJAFI

EXPLORING THE EFFECTIVENESS OF SENSOR-BASED BALANCE TRAINING ON PATIENTS WITH HIV

ABSTRACT: Approximately 1.2 million people 13 years and older are living with HIV in the United States. The most common neurological complication from this infection is neuropathy, particularly distal sensory polyneuropathy (DSP) and antiretroviral toxic neuropathies (ATN). Symptoms of neuropathy may include numbness, pain, and weakness of foot muscles. Such complications can impact balance and gait. In another HIV study, 50% of adults exhibited poor lower limb muscle performance through the five-time sit-to-stand assessment. Such a high frequency puts the HIV-infected population at a high risk of falling. The aim of this pilot study was to evaluate the effectiveness and user experience of a novel balance training program integrating data from wearable sensors into a human-computer interface designed for virtually guided training. Eligible participants underwent 6 weeks (twice a week) of balance training including weight shifting and virtual obstacle crossing. Real-time visual/audio lower-extremity joint motion feedback was provided using validated wearable sensors. Outcome measures included changes in center of mass (CoM) sway in anterior-posterior (AP) and medial-lateral (ML) direction measured during eyes open (EO) and eyes closed (EC) balance testing at baseline and post-intervention. Gait (speed, variability), fear of falling, quality of life, and depression were measured additionally. This is an ongoing study and there is an expectation to see improvement in balance to apply to gait and everyday activities and also an improvement in depression, fear of falling, and quality of life assessments. This study is meant to act as a bridge to encourage patients into a more active lifestyle.

ZACHARY JOSEPH ROMERO

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NEW MEXICO STATE UNIVERSITY

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PI: DR. NANCY HORTON

DNA BINDING OF THE NUCLEASE DOMAIN OF THE NS1 PROTEIN FROM HUMAN PARVOVIRUS B19 TO HOST PROMOTERS AND VIRAL GENOMIC DNA

ABSTRACT: The Human Parvovirus (B19V) infects the majority of the population mainly resulting in mild flu-like symptoms. However, a smaller percentage of those infected develop more severe side effects such as inflammatory cardiomyopathy, hydrops fetalis, aplastic crisis, and autoimmune disease symptoms. The experiments conducted aimed to better understand the function of NS1, which is the B19V's main replicative protein, and its implications pertaining to viral genomic replication and autoimmune disease-like symptoms. The NS1 DNA binding elements (NSBE) from the B19V's genome are essential for viral replication, therefore stoichiometric measurements with the nuclease domain from NS1 were performed to obtain a clearer picture of the mechanisms behind viral replication. The binding affinity of NS1's nuclease domain on promoters from the cell cycle regulation gene p21/WAF1 and the inflammatory cytokine gene promoters for IL-6 and TNF- α were also measured by EMSA to validate previous observations of NS1's transactivation capabilities. Results from this will be used to construct a model of important sequence elements required for NS1 nuclease binding, and the different genes that become trans-activated in the presence of NS1.

KRISTI MESHON SPROWL

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PI: DR. FRANCISCO GARCIA

THE EFFECTS OF DRUG ABUSE AND OVERDOSE IN PIMA COUNTY

ABSTRACT: The synthetic cannabinoid “spice” drug has created an enormous amount of overdoses in the Pima county area of Tucson, Arizona. From April to June 2015, there have been more drug overdoses in Pima County than ever reported before. The Department of Public Health along with the Tucson Fire Department and Poison Control Center have teamed together to retrieve patient data and analyze the overdoses in Tucson. The key role in the analysis is to gain an understanding of who the users of the spice drug are and what behavioral health interventions can be formed to assist this drug abuse issue. The data was collected through the investigations that arose from the overdosed patient and the TFD asked a series of questions to understand the nature of the problem. In turn, the Department of Public Health developed a data set to breakdown the location of the onset to which the overdose occurred and the medical conditions of the patient when found in an overdosed state. The preliminary results have shown that the spice drug overdoses in Pima County are predominantly men who are between ages 21-64 years old. The overdoses are usually located near bus transit centers and the TFD receives calls about overdosed patients from the morning through the afternoon. The Public Health Department are developing interventions to slowly eradicate the series of overdosed patients in Pima County by looking into behavioral health, mental health and substance abuse mediations to assist in drug overdose matters.

SAMUEL CLAY WILLIAMS

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WASHINGTON UNIVERSITY
IN ST. LOUIS

ST. LOUIS, MISSOURI

PI: DR. JASON YUAN

ROLE OF MIRNA-29B IN THE DEVELOPMENT OF PULMONARY HYPERTENSION



ABSTRACT: Pulmonary arterial hypertension (PAH) is a rare but fatal disease that primarily affects women. It is defined by a mean pulmonary arterial pressure equal to or greater than 25 mmHg at rest. While the initial trigger for PAH is unknown, the elevated pulmonary arterial pressure is generally considered to be caused by sustained pulmonary vasoconstriction, pulmonary vascular remodeling and in situ thrombosis. These functional and structural changes in the pulmonary vasculature have been demonstrated to attribute, at least in part, to changes in ion channel activity and expression in pulmonary arterial smooth muscle cells (PASMC). By a microRNA microarray experiment, our lab has recently found that several microRNAs were significantly upregulated in PASMC isolated from patients with PAH in comparison to normal controls. MicroRNAs are small molecules that exert posttranscriptional regulation of gene expression. One of the upregulated miRNAs in PAH-PASMC is miRNA-29b that was predicted through in silico analysis to target the voltage-gated K⁺ (Kv) channel gene, Kv1.5 or KCNA5. To examine whether miRNA-29b functionally interacts with Kv channel genes, we first are comparing miR-29b and Kv1.5 (and other Kv channel genes) in lung tissues and PASMC isolated from rats with experimental pulmonary hypertension (by injection of monocrotaline) using RT-qPCR. Then, we will examine whether inhibition of miR-29b using specific antagmir would rescue downregulated Kv1.5 (and other Kv channel genes) in PASMC isolated from rats with pulmonary hypertension. This study will provide important insights into the development of miRNA-targeted therapies for pulmonary hypertension.



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PROGRAM STAFF AND SPONSORS • 2015

SUMMER RESEARCH INSTITUTE (SRI)

Coordinator: Donna Treloar, MA

Instructors: Andrew Huerta, PhD, Renee Reynolds, ABD,
Joanna Sanchez-Avila

Sponsors: University of Arizona; Graduate College; The Partnership for Native American Cancer Prevention (NACP) training program, a collaboration between Northern Arizona University and the University of Arizona Cancer Center, funded by the National Cancer Institute; College of Medicine – Office of Diversity and Inclusion, Health Resources and Services Administration (HRSA) Centers of Excellence; Western Alliance to Expand Student Opportunities (WAESO); Department of Physics.

MINORITY HEALTH DISPARITIES SUMMER RESEARCH PROGRAM (MHD)

Coordinator: Stephanie Adamson, Holly Lopez

Sponsors: University of Arizona; Graduate College; Western Alliance to Expand Student Opportunities (WAESO).

MAXIMIZING ACCESS TO RESEARCH CAREERS (MARC)

PIs: Megan McEvoy, PhD; Marc Tischler, PhD, Maria Teresa Velez; PhD

Coordinator: Cindy Neal, MEd

Sponsor: NIGMS/TWD Division GM 08718

HOOKED ON PHOTONICS RESEARCH EXPERIENCE FOR UNDERGRADUATES (HOP)

PIs: Nasser Peyghambarian, PhD

Sponsors: University of Washington/National Science Foundation (NSF). Funding for this research was provided by NSF Grant No. CHE-1156598.

CIAN INTEGRATED OPTICS FOR UNDERGRADUATE NATIVE AMERICANS (IOU-NA) RESEARCH EXPERIENCE FOR UNDERGRADUATES

PI: Allison Huff Mac Pherson, DHEd, Robert Norwood, PhD

Coordinator: Ameé J. Hennig, Daniel Lamoreaux

Sponsors: National Science Foundation (NSF) Engineering Research Center for Integrated Access Networks (ERC CIAN).

Funding for this research was provided by the NSF Engineering Research Center No. EEC-0812072.

BIOSPHERE 2

PI: Katerina Dontsova, PhD

Sponsors: National Science Foundation Research Experiences for Undergraduates Program.

STUDENT AFFAIRS RESEARCH PROGRAM (STAR)

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Sponsors: University of Arizona; Graduate College; Division of Student Affairs; Western Alliance to Expand Student Opportunities (WAESO).

UROC-PREP

Coordinator: Donna Treloar, MA

Instructor: Andrew Huerta, PhD

Sponsors: University of Arizona; Graduate College, Western Alliance to Expand Student Opportunities (WAESO).

CAT VEHICLE PROGRAM/ ECE REU

PI: Jonathan Sprinkle, PhD

Coordinator: Nancy Emptage

Sponsor: National Science Foundation Research Experiences for Undergraduates Program

RESEARCH IN OPTICS (RiO)

PI: R. John Koshel, PhD

Coordinator: Melissa Sarmiento Ayala, MEd

Sponsor: National Science Foundation (NSF)

Award No. 1460723.





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