



THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

Undergraduate Research Opportunities Consortium



UROC

Abstract Review

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ADRIAN ACOSTA

STUDENT AFFAIRS RESEARCH PROGRAM

TAR



UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. ANTHONY MUSCAT

TWO-STEP CHEMICAL PASSIVATION OF $\text{In}_{0.53}\text{Ga}_{0.47}\text{As}(100)$ USING 1-EICOSANETHIOL AND AMMONIUM SULFIDE

ABSTRACT: The development of faster, more efficient electronic devices using III-V semiconductors requires surface passivation processes to protect against oxidation and electrical degradation due to the presence of surface states. A two-step, liquid phase surface passivation of the (100) crystal plane of $\text{In}_{0.53}\text{Ga}_{0.47}\text{As}$ with 1-icosanethiol (ET, 20 carbon atom chain) and ammonium sulfide, $(\text{NH}_4)_2\text{S}$, was investigated using x-ray photoelectron spectroscopy (XPS), spectroscopic ellipsometry, and water contact angle. The time required to reoxidize the clean surface of InGaAs samples when exposed to air depended on the order of the passivation steps. The InGaAs substrates were initially cleaned with dilute aqueous HF to remove the native oxides. Immersing a sample first in 3 mM aqueous $(\text{NH}_4)_2\text{S}$ for 20 min followed by 4 mM ET dissolved in ethanol for 20 min did not protect the surface for exposures as short as 4 min. Reversing the steps and immersing first in ET followed by $(\text{NH}_4)_2\text{S}$ prevented oxides from growing for up to 8 min due to reaction with oxygen and water in the air. When ET was deposited first, ellipsometry showed that the overlayer thickness of $41.4 \pm 5.6 \text{ \AA}$ was well above the 26.9 \AA length of an ET molecule and the water contact angle of $106.8 \pm 1.1^\circ$ showed a hydrophobic surface confirming deposition of at least one ET layer. In comparison, a single 20 h immersion in 4 mM ET protected the surface from oxidation for only 4 min. A two-step passivation procedure can offer a significant improvement in the surface passivation of III-V semiconductors.

SAMI D'ALMEIDA

STUDENT AFFAIRS RESEARCH PROGRAM

TAR



UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. MOYSEY BRIO

STABILITY CONTROL OF AN INVERTED PENDULUM

ABSTRACT: In this article a novel method of designing a controller for an inverted pendulum is developed. Laplace transform has been used to solve the differential equations that carried out the factors influencing the dynamic of the inverted pendulum as a continuation of the work proposed by Domenico, Fabio, and Carmine (2010) and then an output-feedback controller has been designed using Single Input Single Output (SISO) tools from MATLAB. Additionally, a stochastic method of initializing the weighting matrices to minimize the performance index of the Linear Quadratic Regulator (LQR) is examined. The stochastic method is based on binomial distribution to initialize the populations in order to minimize the number of iteration used in the traditional PSO introduced by Kavey and Won-sook (2014). The purpose of my research is to investigate a more optimal and low cost method of designing a control system for an inverted pendulum. Upon simulation with MATLAB Simulink it was shown that the new output-feedback controller easily and more effectively controls the stability of the pendulum in its vertical unstable position without the need of any integral gain.

ANNISE DEGONZAGUE

STUDENT AFFAIRS RESEARCH PROGRAM

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UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. ROBERT COLLIER

DETERMINING SIGNIFICANCE OF GLUCOSE, INSULIN, AND CORTISOL IN OMNIGEN-AF FED DAIRY COWS INJECTED WITH ACTH OR CRH-VP

ABSTRACT: In the interest of strengthening the dairy cattle industry against the negative effects of heat stress, the effects of temperature, hormone levels, and nutrition in dairy cattle must be considered. The purpose of the current research is to determine if the feed additive OmniGen-AF has an effect on glucose and insulin concentrations correlative to its known lowering effect on cortisol concentration in dairy cows that were given porcine adrenocorticotrophic hormone (ACTH), vasopressin (VP), and corticotropin releasing hormone (CRH). This study was conducted by running cortisol ELISA (enzyme linked immunosorbent assay) tests, insulin ELISA tests, and glucose oxidase assays on dairy cow blood serum samples from cattle that were fed OmniGen, treated with ACTH and CRH-VP, and were subjected to either thermoneutral environments and heat stress environments. The software system Statistical Analysis System (SAS) was used to analyze the data collected from these assays so that a correlation between cattle cortisol, glucose, and insulin concentrations could be determined. Insulin concentration was found to be significantly different over time in OmniGen and control cows during the heat stress ACTH challenge. Cortisol concentration was found to be significantly different between treatments and environments within the ACTH challenge and between environments within the CRH-VP challenge. Glucose was not found to have any significant differences within this study.

MARIA LOURDES ESCALANTE

STUDENT AFFAIRS RESEARCH PROGRAM



UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. JAMES C. HOPKINS

INDIGENOUS YAQUI NATION FIGHTS FOR RIGHTS & WATER: A LOOK INTO THE SYSTEMATIC, INHUMANE POLICIES OF THE GOVERNMENT OF MEXICO

ABSTRACT: For over a century, the Yaqui Nation from Sonora, Mexico has dealt with unjust policies from the Mexican government, which the Yaqui Nation currently deals with to this day by defending their rights to their water. This study was undertaken due to the development of inhumane policies that the government of Mexico, the State of Sonora and the economic private interests have undertaken in order to delegitimize, displace and further the pattern of policies set out by the Porfiriato Dictatorship. Addressed in this paper is a timeline of the Mexican government's relationship with the tribe and delineation of policies affecting the Yaqui Nation. The United Nations Declaration on the Rights of Indigenous Peoples is used to connect the injustices made. The Peoplehood Matrix Theory will be used to understand the relationship of water, traditional territory, and history of the Yaqui Nation. A driving purpose of this study is a further need to continue the documentation, analysis and data collection that is necessary to further argue that the indigenous Yaqui Nation is in peril. This paper attempts to answer through the scope of these theories and input by the U.N.: what has led up to the current human rights and indigenous rights issue that the Yaqui in Mexico currently face, which has led to the creation of discourse between UN Special Rapporteur James Anaya and Chair of the UN Permanent Forum on Indigenous Issues, Paul Kanyinke at the Binational Forum on the Yaqui Basin in 2013.

SYDNEY HALIBURTON

STUDENT AFFAIRS RESEARCH PROGRAM

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UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. BRYAN CARTER

BLACK WOMEN AND INFORMAL LEADERSHIP WITHIN THE BLACK LIVES MATTER MOVEMENT

ABSTRACT: Previous discourses on the roles Black women traditionally played in social movements focused on uncovering specific roles and positions Black women occupied that had been lost to history. Through examination of narratives and interviews of relevant figures, scholars were able to examine how the identities of race, gender, class and sexuality influence leadership style and one's visibility. In examining the roles Black women played, the themes of micromobilization, decentralized, and communal leadership as being niche to Black women due to their various identities was established. The terms that became relevant in defining this leadership were the concepts of Informal and Bridge Leadership. In utilizing these themes and definitions as a framework to critically break down the multiple facets and benefits of this system of leadership implemented by Black women, a research question was developed that analyzed the structure, framework, and leadership of the Black Lives Matter Movement, and explores how the leadership style reflects and contrasts that of Black women's previous leadership roles in Civil Rights Movements. The methods implemented analyzed and identified five areas of the Black Lives Matter Movement, with emphasis on Battle Fatigue, Intersectionality, Micromobilization, Power Structures, and Reformation of Liberation Movements. Results show that the actions of current social movement activists reflects that of previous Informal and Bridge leaders, and calls for further expansion on the understanding of how this distinct style of leadership creates a system that redefines what power and opposition are in a contemporary social and political movement.

LAURA Jael KURTZBERG

STUDENT AFFAIRS RESEARCH PROGRAM

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UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. JOOST VAN HAREN

REINVENTING THE PLOT DIAGRAM: USING D3.JS AND KML IN GOOGLE EARTH TO EXPLORE METHANE FLUX DATA FROM THE PERUVIAN AMAZON

ABSTRACT: Recently, data visualization methodologies are being adopted by environmental and earth scientists not only for the presentation of results, but for the analysis of data while research is in progress. This new idea, analytical visualization, has become easier than ever before with the astounding amount of environmental data that is openly available, along with accessible tools that scientists can use to explore the data. With analysis and outreach as principal goals, a new analytical visualization was created for methane flux data from field research in the Peruvian Amazon wetlands. The plot diagram, traditionally used to show positions of trees, was enhanced with D3.js and KML to create an interactive diagram suitable for publication on the web. This new plot diagram will be used to help explain variability in methane flux and to immerse high school students from Iquitos and Tucson in the process of scientific exploration.

MELISSA LOPEZ

STUDENT AFFAIRS RESEARCH PROGRAM

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PI: DR. CRAIG ASPINWALL

SURFACE DEGRADATION OF NANOPARTICLES COMPOSED OF POLYSTYRENE CORES AND SILICA SHELLS

ABSTRACT: The purpose of this study is to better understand how the surface of core-shell nanoparticles composed of polystyrene cores and silica shells may change over time. Particles were prepared using seven different ratios of silica with functional groups: tetraethyl orthosilicate (TEOS) for hydroxyl, 3 aminopropyl triethoxysilane (APTES) for amine, or 3-mercaptopropyl trimethoxysilane (MPTS) for thiol functional groups. Measurements were taken over a period of eight weeks every two or three days. The importance of this study lies in investigating how the surface of particles change over time, an important parameter in functionalizing nanoparticles with proteins, DNA, and other binding molecules. Results show no clear trend that indicates the degradation of the particle surface based on zeta potential. Moreover, 20% APTES and 20% MPTS coated nanoparticles, which have not been prepared before, were synthesized and have different zeta potentials from those 5% or 10% APTES or MPTS coated nanoparticles

KASSANDRA MANRIQUEZ

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TUCSON, ARIZONA

PI: DR. ADAM GEARY

SOLIDARITY IN HOMELESS COMMUNITIES

ABSTRACT: This analytical paper is about the homeless and uncovers the systematic division of homeless communities. Among many things, the homeless rely on one another for safety, support, and survival; solidarity is a survival strategy used by the homeless. Prior research on homelessness tends to neglect the role of solidarity in the lives of the homeless and instead focuses on self-reliant survival strategies. This paper answers the research question: why and how does the state dismantle solidarity in homeless communities? The methodology includes an analysis of a case study, scholarship on homelessness, scholarship on solidarity, and feminist literature to better understand the state's relationship to the homeless. This analytical paper opens with a case study that raises questions about the importance of solidarity and the state's treatment of homeless communities; an explanation of solidarity and survival strategies follow. Feminist theory, including literature by Audre Lorde, bell hooks, and U.S. Third World Feminists, is applied as a framework to understand the significance of survival strategies and to unpack the state's desire to divide homeless communities. Though the state justifies dismantling homeless solidarity in terms of public health and safety and does so by criminalizing homeless survival strategies, there are hidden reasons the state isolates the homeless from one another. This paper argues that the state divides homeless communities to uphold the values of patriarchy and capitalism, to keep the homeless in their place, and because the state fears difference.

FATIMA FAITH MOLINA

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PI: DR. FRANCINE GACHUPIN

TARGETING TYPE 2 DIABETES: A SUMMER MEDICAL WELLNESS CAMP FOR AMERICAN INDIAN ADOLESCENTS

ABSTRACT: According to the Centers for Disease Control and Prevention, diabetes is the fourth leading cause of death among American Indians/Alaskan Natives, with heart disease noted as the second leading cause. The American Indian Summer Medical Wellness Camp, established in 1991 by the Native American Research and Training Center through the University of Arizona, is designed to target and inform American Indian adolescents about the prevalence of Type 2 Diabetes Mellitus and other obesity-related diseases. American Indian adolescents from a variety of tribal communities located within the Southwest region were able to attend the residential Wellness Camp for one week, where they learned about the prevalence of Type 2 Diabetes through informational sessions, nutritional tutorials, physical activities, and traditional values concerning disease prevention methods. Determining the success of the program involved the analysis of obtained metabolic data from 2014 and 2015. The metabolic data has shown a slight decrease in total weight, fat %, body fat mass, and the body mass index for both 2014 and 2015. The only difference shown is the slight increase in lean body mass for 2014, opposed, to the slight decrease in lean body mass for 2015. Overall, the American Indian Summer Medical Wellness Camp is an effective and ideal program for targeting Type 2 Diabetes among American Indian adolescents.

DANIEL NIKOLIC

STUDENT AFFAIRS RESEARCH PROGRAM

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TUCSON, ARIZONA

PI: DR. PAUL WILSON

SOCIAL CAPITAL, CULTURE, AND INSTITUTIONS AS DETERMINANTS OF ENTREPRENEURSHIP IN A DEVELOPMENT CONTEXT

ABSTRACT: Entrepreneurship is still a social term that scholars have difficulty defining, and a lack of consistency in theory in turn leaves researchers without an accurate way to measure entrepreneurial activity. A working definition and theory of the entrepreneur is provided as a way to synthesize the various multi-disciplinary approaches taken towards entrepreneurship in past literature, with emphasis on welfare and judgmental decision-making under uncertainty. Past studies find significant relationships between economic growth and the level of entrepreneurial activity in a country. Little is known, however, on which elements of a society contribute to entrepreneurship and which do not. This study examines the effects that social capital, culture, and institution measures have on the level of self-employment in a country, with specific focus on developing countries. Results of this cross-country regression analysis form a model of entrepreneurship with significant explanatory power from property rights, productivity, and trust.

ALBA RUBY RAMOS

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UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. CHRISTOPHER SCOTT

SECTORAL AND SPATIAL DISTRIBUTION OF WATER RIGHTS IN THE SAN MIGUEL RIVER BASIN, MEXICO: WATER SECURITY AND CLIMATE-CHANGE ADAPTATION CHALLENGES

ABSTRACT: The state of Sonora, Mexico, is facing growing challenges as climate change progresses and water resources become scarcer resulting in competition. Agriculture/livestock, industry, and urban centers will have to compete for water supplies from the depleting aquifers or search for alternative water supplies. The San Miguel River Basin, located north of the capital of Hermosillo, covers six municipalities, although the majority of the watershed lies within four of them (Opodepe, Cucurpe, Rayón & San Miguel de Horcasitas). These municipalities rely mainly on agriculture, livestock, and industry. This paper examines the intersectoral allocation of water among agriculture and livestock in comparison to urban water supply and industry across these four municipalities. This research quantifies the degree of use-rights concentration by calculating the Gini-coefficients of the separate water use sectors for these four municipalities. By comparing the volumes of water allocated by permit to water users in each of the municipalities and their declared purpose —as published in the National Water Commission (CONAGUA) Public Registry of Water Rights (REPGA) data base, the estimated magnitude of water use in the basin and inequities in allocation are assessed. Additionally, the spatial concentration of water rights is mapped. We find that within economic activities like agriculture, a few large-volume users hold unequal and inequitable rights when compared to numerous small-volume users, most of the water rights are held by agricultural and livestock/grazing activities, and the volume of total water titles on the watershed has decreased over the years. Growing water scarcity will affect all users of waters; however, the inequities shown in our analysis indicate that some users within the agricultural sector have disproportionately captured water rights, making climate-change adaptation even more difficult for small volume rights holders.

JAIME NICHOLE ZETTLEMOYER

STUDENT AFFAIRS RESEARCH PROGRAM



UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

PI: DR. MAHA NASSAR

NAVIGATING NATIONALISM: A LITERARY ANALYSIS OF PALESTINIAN WOMEN'S AGENCY

ABSTRACT: Nationalist discourses can function like narratives, and in order to gain legitimacy, these narratives must promote notions of a united community. When discussing Palestinian nationalism, social scientists have tended to focus on the hegemonic, patriarchal nature of nationalism, and they argue that it has been used to oppress and marginalize women. Other social scientists have argued that although Palestinian nationalism can act as a patriarchal force, it also creates political opportunities for women. However, both sets of scholars in this field have neglected to note the agency and abilities of women to navigate the hegemonic structures put in place by nationalist projects. I argue that Palestinian women employ different strategies to create political and non-political opportunities for themselves within the structures established by Palestinian nationalism, which has yet to be noted in the scholarship on this topic. I posit that because nationalism is a form of narrative, the analysis of novels as counter-narratives will present a deeper understanding of the relationship between gender and nationalism. Analyzing literary examples that depict motherhood and the appropriation of women's bodies, which have been considered to be sources of marginalization, have nonetheless been utilized by to navigate their roles in society and to create opportunities for themselves. Understanding these counter-narratives deepens our understanding of not only how nationalism marginalizes women or creates opportunities for them, but also the ways in which these women navigate their own societies as active agents within their lives and within the nationalist movement.



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Coordinator: Donna Treloar, MA
Instructors: Andrew Huerta, PhD, Renee Reynolds, ABD,
Joanna Sanchez-Avila

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

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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).

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BIOSPHERE 2

PI: Katerina Dontsova, PhD
Sponsors: National Science Foundation Research Experiences for Undergraduates Program.

STUDENT AFFAIRS RESEARCH PROGRAM (STAR)

Coordinator: Nura Dualeh, MA
Instructors: Andrew Huerta, PhD, Renee Reynolds, MA, Joanna Sanchez-Avila
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
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