First Annual St. Mary's Research Week

April 19-23, 2021



The Catholic and Marianist University

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Schedule of Events

Monday, April 19, 2021	
10:00 – 11:00 am 12:00-1:00 pm 1:00-2:00 pm	Faculty training: Finding funding Student training: Finding internships Texas LEARN Consortium and Enhanced Web
1:30-2:30 pm 3:00-5:00 pm	Access McNair recruiting session Opening Plenary session
Tuesday, April 20, 2021 9:30-10:30 am 10:30-11:30 am 2:00-5:00 pm	Project Director Panel Discussion Faculty training: Basic Grant writing Faculty Research Symposium
Wednesday, April 21, 2021 9:00-10:00 am 10:00-11:00 am 11:00 am-1:00 pm 2:00-5:00 pm	Student training: Creating Research Posters/Papers Faculty training: Research mentoring Westside San Antonio Humanities Project, Day 1 22 nd Annual Research Symposium and Creative Activities Exhibition (Alumni Athletics & Convocation Center)
Thursday, April 22, 2021 9:30-10:30 am 10:30-11:30 am 12:00-1:00 pm 12:30-1:30 pm 1:30-3:30 pm 3:30-4:30 pm	Manuscript Writing Cohort Faculty training: Budgeting Student training: Resumes, personal statements and CVs Grant Writing Cohort Westside San Antonio Humanities Project, Day 1 University Research Council meeting
Friday, April 23, 2021 9:30-10:30 am 11:00 am-12:00 pm 1:30-2:30 pm 4:00-6:00 pm	Student training: Research FAQs Faculty training: Logic models Cimadevilla Seminar Series Closing Reception (Pecan Grove)

Acknowledgments

The Office of Student Research and Inquiry, and the Sponsored Projects, Academic Research and Compliance Office, would like to thank all the St. Mary's students and faculty for their dedication to research and inquiry. Your persistence and hard work in these trying times are a testament to the strength of our community. As always, heartfelt gratitude to the faculty who tirelessly mentored students on their projects, as well as those who volunteered to judge.

In addition, the 22nd Annual Research Symposium and Creative Activities Exhibition would not have been possible without the support of the Provost's Office, the members of the University Research Council, and all the Deans. Special thanks go to Aramark, Facilities, Academic Technology Services, and others who are often unseen for their support. Your generosity of time and spirit has been instrumental in showcasing the academic achievements of St. Mary's University.

Letter from the Provost



Office of the Provost and Vice President for Academic Affairs One Camino Santa Maria San Antonio, Texas 78228 Office: 210-436-3716 Fax: 210-431-4213 www.stmarytx.edu

April 15, 2021

Dear Fellow Researchers,

Thank you for contributing to the 22nd Annual Academic Research Symposium. Your work is an outstanding contribution to the creation and publication of new forms of knowledge. Such knowledge satisfies our curiosity and helps us to imagine and create a more human world. Through your research, you join a community of scholars at St. Mary's and around the world. Working together, we inspire one another in the search for the truth in its many forms.

Thank you for making this Symposium a priority part of your educational experience. I hope you find it to be an energizing learning-experience that inspires you to keep asking the difficult questions and pursuing the challenging research that answers those questions. No insight is too small, and every genuinely human question is worthy of its own study.

At its heart, the scientific method relies on collaboration and mutual respect to advance. St. Mary's faculty and staff are delighted to support your scholarships as mentors, co-researchers, and reviewers. We are excited to see the results of your work.

Please accept my congratulations on the scholarly achievements that you are showcasing with us this week.

With High Regards,

William D. Buhrman, Ph.D. Interim Provost and Vice President for Academic Affairs

St. Mary's University, as a Catholic Marianist University, fosters the formation of people in faith and educates leaders for the common good through community, integrated liberal arts and professional education, and academic excellence.

Opening Plenary Session

Monday, April 19, 2021

3:00-5:00 pm Welcome remarks, Provost William Buhrman Keynote Speakers "Promoting Experiential Learning and Creative Activities – a Discussion with our Deans", Winston Erevelles, Ph.D., Leona Pallansch, Ph.D., Patricia Roberts, J.D., and Stephanie Ward, Ph.D. "Putting Pedagogy First in the Digital Humanities: Low-Risk Inroads to Digital-Methods Research through Faculty-Student Partnerships" Kalani Craig, Ph.D., Indiana University Bloomington "From Textbooks to Pay Checks: The Role of Undergraduate Research in your Career Success", Gina Buffaloe and Chris Flores, Ph.D. Closing remarks

Faculty Research Symposium

Tuesday, April 20, 2021

2:00-2:15 PM	A deeper look into the relationship among Authentic Leadership, Behavioral Integrity, Project Governance, and Project Success, Dr. Ajaya Swain, Associate Professor, Greehey School of Business
2:15-2:30 PM	Reforming the Household of God: Five Models of Christian Identity, Dr. Allison Gray, Program Director & Associate Professor Theology
2:30-2:45 PM	<i>Research During a Pandemic: A Story of Adaptation,</i> Dr. Todd Hanneken, Chair & Professor Theology
2:45-3:00 PM	Exploring the Indicators of Altruism in Undergraduate Medical Education at UT Health Long School of Medicine, Dr. Sue Nash, Assistant Professor Sociology and Dr. Janet Armitage, Chair & Associate Professor Sociology
3:00-3:15 PM	"Tenéis un acento muy diferente": Latinx students studying abroad in Spain, Dr. Meghann Peace, Associate Professor Languages
3:15-3:30 PM	Securitization of female asylum seekers and healthcare in detention centers in Texas, Dr. Claudia Donoso, Assistant Professor International Relations
3:30-3:45 PM	Needs for Zambian children with atypical development: Perspectives of stakeholders, Dr. Jillian Pierucci, Chair & Associate Professor Psychology
3:45-4:00 PM	Creative Dolphins – Killer whales (Orcinus orca) and Bottlenose dolphins (Tursiops truncatus), Dr. Heather Hill, Professor Psychology
4:00-4:15 PM	Assessment of population characteristics of a wild canid population on Galveston Island, TX, Dr. Melissa Karlin, Associate Professor Environmental Science
4:15-4:30 PM	Redundant or Indispensable? Deciphering roles for β -tubulins in health and disease, Dr. Veronica Contreras-Shannon, Professor Biological Sciences
4:30-4:45 PM	Synthesis and Crystal Structure of Diimide and Phosphonate-Based Coordination Polymers, Dr. Pius Adelani, Associate Professor Chemistry
4:45-5:00 PM	From Inner Earth to Outer Space: How Studying Caves on Earth Relates to Studying Mars and the Moon, Dr. Evelynn Mitchell, Professor Environmental Science

Westside San Antonio Humanities Project

With O'Connor Chair resources, the St. Mary's University's Westside San Antonio Humanities Project funded ten faculty-student teams to research and showcase aspects of the culture and history of San Antonio's Westside neighborhoods throughout 2020-2021. Known historically as Barrio Laredo (18th century), Laredito (19th century), the Latin Quarter (early 20th century), and now the Westside, this predominantly Mexican American section of the city has grown dramatically during the last two centuries but few know of its rich history and culture. Please join us in celebrating San Antonio's Westside which has hosted St. Mary's University campus since 1894. All sessions are accessible at: https://stmarytx.zoom.us/i/96288164551

Wednesday, April 21, 2021

11:00AM: Gerald E. Poyo, Lindsey Passenger Wieck, & Amanda Hill, Westside Humanities Project Introduction

11:05AM: Gerald E. Poyo & Edgar Velázquez Reynald, "Latino St. Mary's: the 1930s & the 1960s"

11:30AM: Rick Sperling & Micaela Cruz, "Mexicanidad on the Westside: Tracing the Legacy of Incomparable Servingness at Our Lady of the Lake University"

11:55AM: Meghann Peace & Yamilet Muñoz, "Bilingual, Biliterate, and Bicultural: Dual Language in Westside Schools"

12:20PM: Bernadette Hamilton-Brady & Jorge Martinez, "IDENTIDEM <—>IDENTIDAD<— >IDENTITY: A Transformative Theatre Project Capturing the Spiritual and Cultural Realities of Youth and Young Adults in Holy Rosary Parish, San Antonio, Texas"

12:45PM: Amanda Hill & Sydney Jara-Barrio, "Westside Stories: A Virtual Platform to Showcase the Research of the Westside San Antonio Humanities Project"

Thursday, April 22, 2021

1:30PM: Lindsey Wieck & Victoria Villaseñor, "Water and Structural Inequities in the Westside: Remembering the Flood of 1921"

1:55PM: Joseph Gershtenson & Cynthia Rodríguez, "The Influential Leaders of San Antonio's Westside"

2:15PM: Sue Nash & Angely Noriega Baron, "The Effect of the Housing Crisis on Westside Community Health: A Focus on Historical and Present Day Epidemics/Pandemics"

2:40PM: Claudia Donoso & Kathryn Kokkler, "Education Inequality in Westside San Antonio during the COVID-19 Pandemic: The Case of Lanier High School"

3:05PM: Teresa Van Hoy, Harold Johnson, & Gerardo Nino Pozos, "Black in the Barrio: African American History of San Antonio's Westside"

22nd Annual Student Research Symposium and Creative Activities Exhibition College of Arts, Humanities and Social Sciences

The Humanities

Communication Studies

1 Karina Nanez

Going Green: The Price of Sustainable Products and Their Inaccessibility

As years have gone on, climate change and environmental issues caused by it, have become an important matter to deal with. Rising temperatures, devastating storms, drought, and rising sea levels have all led to drastic changes in the lives of humanity and animals alike. With these pressing issues, there have been thousands of charities and businesses created that directly try to combat climate change. To see if these products are accessible to college students, a survey was created and sent to undergraduate students at the St. Mary's University School of Science Engineering and Technology. Asking students to anonymously answer questions on their personal attitudes towards environmental issues and their proclivity to choose specific household items based on price or environmental impact. At the end of the study, it was found that while students had an increased awareness of environmental issues and a desire to purchase environmentally friendly product, a majority of the responses showed students choosing traditional household products over their sustainable counterpart. While the research conducted does not explicitly examine any connections between gender and sustainability, it does attempt to illustrate any discrepancies between price and purchasing of sustainable products. If the desire to combat climate change cannot outweigh the feasibility or affordability of making necessary changes than there needs to be an overhaul of the communication and pricing around these products.

Research Mentor: David Turner, Ph.D.

OL Katherine Golden

PhD in Counseling Education and Supervision

The Degree of Relative Influence of Autism Severity Diagnostic Domains on Parental Stress

This study investigated the degree of relative influence of autism diagnostic domains (restricted/repetitive behavior, social interaction, social communication, and emotional response) in relation to overall parent stress using the Gilliam Autism Rating Scales Third Edition (GARS-3) and the Parent Stress Inventory Short Form Fourth Edition (PSI-SF). A sample of parents with children formally diagnosed with autism from the ages of 3-12 was recruited from a local non-profit organization that provides ABA services to families with autism. The parents were sent a link to a Qualtrics survey that contained the entire PSI-4 SF and GARS-3 instrument questions. Correlational and regression analyses were used to analyze the data. Results of this study confirmed previous findings in the literature that autism severity is significantly correlated and is a significant predictor of parent stress. In the present study, the researcher failed to find a significant degree of influence of GARS-3 formative diagnostic domains in relation to overall parent stress. Additionally, there were no significant findings among demographic variables (age of child, age of parent, marital status) and stress levels. Item analysis suggested that parents with children with more severe autism may feel lonelier, have lower feelings of self-efficacy, have more relationship problems, and may feel trapped with their responsibilities as a parent; further research may be warranted to investigate these findings. A limitation of this study, however, is that there was a small sample size which limits the statistical power and generalizability of the findings.

Research Mentor: Dan Ratliff, Ph.D.

2 Sabrina Fernandez

Master of English Language and Literature

Sentence Types and Coordinating Conjunctions: The Cat in the Hat and Woman Hollering Creek

To understand English grammar, students must learn: what a sentence is; the different sentence structures such as simple sentences, compound sentences, and compound-complex sentences; and the different types of sentences such declarative, interrogative, imperative, and exclamatory. According to Kolln, Gray & Salvatore, a sentence is "a word or group of words based on one or more subject-predicate, or clause, patterns." Further in linguistics, "the written sentence begins with a capital letter and ends with terminal punctuation - a period, question mark or an exclamation point" (Kolln, Gray & Salvatore, 347). These are some basic definitions of what a sentence consists of grammatically. This presentation explores the different sentence structures and types, the use of conjunctions as coordinating conjunctions, and syntax between two different genres: one, a children's beginner's book, The Cat in the Hat by Dr. Seuss, and second, a short story, Eleven by Sandra Cisneros. A particular question that arises when comparing these two words is: why does an author choose to begin a sentence with a coordinating conjunction?

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

3 Shanita Frazier Remy Levy Ana Rojas Rhiannon Broussard

Learning About Languages by creating a new one: The Language of Bael Fen.

Constructed Languages, or conlangs, first became popular with J.R.R. Tolkien's creation of the languages Quenya and Sindarin for Middle Earth in The Lord of the Rings. Tolkien called the language creation process glossopoiea. Our team, Bael Fen, has engaged in glossopoiea to develop a conlang, Swampspeak, spoken by the Firelings, the people of Bael Fen. Based on our culture, Bael Fen, meaning fire swamp, we developed our language in relation to our socio-cultural and natural environments. We have two seasons, warm and hot that are very humid. It rains almost every day. Our people are known for being expert fishermen, omnivores, polytheists and pacifists. We have an egalitarian society with no regard for gender. To demonstrate our language in action, we composed an original legend, "What the Water Gave Us," that explains how Bael Fen came to be. To construct our language, we crafted the following linguistic layers: phonology, orthography, morphology, lexicon, syntax, semantics and pragmatics. Our phonological inventory includes 7 vowels and 14 consonants from which we have created a lexicon that includes roughly 250 words in a variety of semantic fields, such as familial relations and titles. In Swampspeak, nouns and verbs can be identified by their morphological patterns such as word order or changing tenses, respectively. The default word order of the language is Subject Verb Object, but it can change in certain circumstances. Using Inkspace and Glyphter, we created our own orthography to write a legend in Swampspeak. We hope you enjoy it!

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

Keisha Swarner
Catherine Centeno, Master of English Literature and Language
Serena Frank
Kaila Sto. Domingo
Allison Alvarez

The Language and Culture of Cran Weald (Crane Wood)

The Inventing Languages course is utilizing Mark Rosenfelder's process of language creation as a model (Rosenfelder 2010) to develop a language, the process J.R.R. Tolkien called glossopoiea. This includes creating the following linguistic layers: phonology, morphology, lexicon, orthography, and syntax. We have analyzed linguistic change and development of fantasy languages in Rosenfelder's book The Language Construction Kit and considered these transitions in relation to our glossopoeiac language. Based on our culture Cran Weald, Old English meaning Crane Wood, we developed our language in relation to our socio-cultural and natural environments. We have four seasons but very light winters. Due to the four seasons, our farming and gathering is stable in our Sacred Forest. We are herbivores; therefore, our food sources are mostly fruits and vegetables (rarely hunt animals). We know all the animals and are friends with them, but we have no domesticated animals. Our people are known for living a peaceful and harmonious life. We gather within our culture peacefully, and we exchange goods with neighboring villages for stories and food, to avoid killing animals. We live in an egalitarian society, but with strict age segregation, and monotheistic religion with a nature orientation. To demonstrate our language in action, we composed an original legend that explains how/why we have a nature orientation religion. It shows how our God is everywhere with wind, animals, but most importantly in our Sacred Forest, our requests such as offspring in the form of a seed, or making sure we trade peacefully, is granted by the Forest, which gives us rain as a sign of good luck.

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

Didier E. Cadena
Ghadah Alfulayj, Master of English Literature and Language
Gabriella Gonzalez
Angeles I. Silva
Galilea Ibarra

MEDULA As New Language

Constructed Languages (conlangs) have exploded in popularity in recent television shows such as Dothraki in Game of Thrones, as well as in films such as Na'vi in Avatar. J.R.R. Tolkien, who invented languages such as Quenya in The Lord of the Rings, called the language creation process glossopoiea. Our team Mere Wudu has engaged in glossopoiea to develop a conlang, Medula of the Meredians. Based on our culture, Mere Wudu (lake forest) we developed Medula in relation to our socio-cultural and natural environments. We have two seasons, warm and hot; it rains almost every day. We are known as expert saltwater fishermen, omnivores, and hunter-gatherers. Our culture is monotheistic, but we accept all religions and genders. Our original legend, "Hunting in the Dark," explains a day in the life of a Meredian. To construct Medula, we crafted the following: phonology, orthography, morphology, lexicon, syntax, semantics and pragmatics. Our phonological inventory includes 8 vowels and 25 consonants from which we have created a lexicon that includes about 296 words in a variety of semantic fields, such as activities and family. In Medula, nouns and verbs are identified by their morphology as indicated by suffixes and prefixes. The default word order of the language is SVO, but it can change in certain circumstances such as when asking a question. In cases like this it changes to VSO. Using Inkspace and Glyphter, we created our own orthography to write a story in Medula. We hope you enjoy it!

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

OL Seana Barclay

Didier Cadena Catherine Centeno, Masters in English Literature and Language Joshua Collins Alexis Garcia Emily Kelly Ashley Lucio, Masters in English Language and Literature Angelique Maldonado Andrea Moreno Celeste Perez Gonzalez Richard Ramirez, Masters in English Literature and Language Ernie Sano Brandon Schmidtling Sarah Uhlig Hannah White What Does a Digital Archive of Literature Created During Covid-19 Tell Us? Reading and Writing in the Pandemic

An important role of literature is to make the invisible visible. By creating a digital literary archive, this project, created by students in Research in English and Cultural Studies, tracks some of the invisibilities of Covid-19, made visible in poetry, fiction, essays, diaries and scripts both published and unpublished. Booklists, sales from booksellers, social media and interviews track the large rise in the reading of poetry, fantasy, comics and the classics--in part as 'safety nets' for the psyche. Using the critical methodologies of English and Cultural Studies, students created 'critical questions' to select and interpret literary works and material objects for inclusion in the archive. Existing archives and websites were researched as possible models for access and future research. While archives traditionally preserve and 'create a useable past', our sample archive suggests that it may also tell us about our possible future.

Research Mentor: Alice Kersnowski, Ph.D.

OL Lane Riggs Master in English

The Modality Expressed by Virginia Woolf's and Edna O'Brien's Modals

In Mrs. Dalloway by Virginia Woolf and in Country Girl by Edna O'Brien, modals are heavily relied on. Modals, reflexive and intensive pronouns, prepositions, and expletive "there" transformations contribute to the novels' more feminine narratives, and serve to help the writers to reveal the women at the center of their plots and, for Edna O'Brien, these grammatical structures reveal herself. Edna O'Brien uses modals sparingly, with a total of two. The only modals she uses represent her hope, the future, and consistency. Instead, O'Brien switches modals for gerunds, especially in a paragraph about Bang-Bang. Similarly, O'Brien uses the expletive "there" to point out characters like Bang-Bang while Woolf uses "there" to signify the ringing of Big Ben. Both uses of "there" mark the transformation as "providing information of place" and "acts as a kind of pointer"(Kolln 96-97). The use of reflexive and intensive pronouns work to emphasize the character's selves and help the reader get to know those characters better. Therefore, grammar is not only essential to the completion of these novels, but to the narrative and characters within, and to these women writers who fully utilized their craft to explore their own femininity and feminism.

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

6 Isabella Carmona

German American & German Latin American Internment During WWII

During WWII, Germany and their allies were considered enemies of the United States. But that did not just include the countries, but also the citizens and even noncitizens that were of German descent. Men who resided in Latin America or in the United States were questioned and thought of as spies for Germany and placed into the camps with their families and sometimes just alone. The internment camps were not as bad as the concentration camps in Germany, but they did have a negative and traumatic impact on the individuals forcefully put in them. My project focuses particularly on Arthur Jacobs, an American-born child interned during WWII. This research draws from a portfolio of photos taken at the internment camps, a few historical websites talking about the history of internment camps, and from a brief biography of Arthur Jacobs from the website of an Emmy Nominated film called Children of Interment directed by Joe Crump and Kristina Wagner.

Research Mentor: Teresa Van Hoy, Ph.D.

7 Matias Machado

GREAT-GREAT-GRANDFATHER STORY

During the Second World War, the Germans who lived in Peru and Latin America were mainly kidnapped and taken to internment camps in the USA. My research focuses on the story of my great-great-grandfather, who was a german leaving in Peru during Second World War.

Research Mentor: Teresa Van Hoy, Ph.D.

8 Adriana Rodriguez

"Freedom in Exchange for Barbed Wire"

My research focuses on the German-Internment Camps in Crystal City, Texas during WWII, including German-American and German-Latin American internees. My findings reveal that Internees refused to relinquish their hope, culture, and individuality even though they were ripped from their freedom. My project utilized the following sources: Internee memoirs, census records, a public domain film produced and published by the Immigration and Naturalization Service, research from author Jan Jarboe Russell, and images from the U.S. Internment Camp, Crystal City, TX Facebook group.

Research Mentor: Teresa Van Hoy, Ph.D.

9 Claudia Sanchez

The Key to the Keyhole Club

This film dives into the San Antonio jazz scene of the 1950s and takes a close look at the infamous Keyhole club and its founder Don Albert. Oral interviews, old photographs, and the memories of former Keyhole Club attendees carry the legacy of integration and diversity that set this San Antonian nightclub aside from the others of its time. With its goal to unite hearts and minds through jazz, the Keyhole Club was a key part of the rising movement to desegregate San Antonio.

Research Mentor: Teresa Van Hoy, Ph.D.

10 Shyann Francis

German POW and Internment During WWI

The Unites States interned German and Japanese Americans during World War II so I examined where the idea originated from. Using the Migration Heritage Center as well as other Australian government resources, Australia interned those of German and Austrian Slavic descent during World War I in unsanitary conditions which resulted in a spread of culture in the areas near the camps. At the end of the war, Australia deported citizens, immigrants, and prisoners alike to Germany.

Research Mentor: Teresa Van Hoy, Ph.D.

OL Nichole Crawley

The Unspoken Truth of American History: German American Internment

My project is a call to action for German Americans and German Latin Americans who were incarcerated in internment camps during World War II. Drawing on presidential signings, orders, acts, and other government documentation for the authorization of this imprisonment, and upon the exchange of prisoners of war, I argue that the detention was an injustice and violation of basic human civil rights. No governmental responsibility has been taken nor addressed adequately for these victims.

Research Mentor: Teresa Van Hoy, Ph.D.

11 Regina de la Parra, McNair Scholar

Painting the sky blue: Comparing the Policies, Plans, and Regulations to Reduce Air Pollution in Beijing and Mexico City

Outdoor air pollution, also known as one of the silent killers, is a global issue affecting the lives of millions of people. There are many causes of air pollution, with data showing manmade sources as the leading producers. Yearly, more than 7 million people around the world die due to air pollution. From these 7 million people, 2 million are located in the Western Pacific Region and 1 million in the Africa region. While there is a lot of information available, there is currently a lack of research that compiles and compares information from various nations, including independent, comprehensive studies on the regulations and rate of success of nations such as those done regarding "blue sky days" in Beijing, China. While many nations handle air pollution in a similar way, some countries are better than others at regulating air pollution. This is supported by the fact that many cities within the same region have better air quality than others, as well as the fact some nations are better at implementing policies and regulations, and nations with a long history of air pollution know which practices work best when reducing this. By analyzing the Mexico City Metropolitan Area and the Beijing Metropolitan Area, this paper will compare the success of their policies that seek to reduce air pollution as well as understand which of these similar policies, regulations and practices work best. Lastly, this report will provide a comprehensive summary of these regulations which will serve as a guide for individuals, local governments and nations.

Research Mentor: Aaron Moreno, Ph.D.

12 Celeste Flores

The Correlation of Low-Quality Education and Youth Crime in Mexico and Turkey

Mexico's low-quality education is leading to rising rates of teenagers joining narco cartels. However, in Turkey, a similar country, their education system leads to less youth crime. This study aims to analyze both countries' educational systems in-depth to determine the Turkish policies Mexico could implement to improve their educational systems and decrease youth crime rates. This research will examine both countries' demographic information provided by the Organisation for Economic Co-operation and Development (OECD) to reach an accurate conclusion.

Research Mentor: Ian Smith, Ph.D.

OL Camryn Blackmon, McNair Scholar

Hardship in the Age of COVID-19: A Case Study of Remittance Inflows from the United States to Rural Communities in Jalisco, Mexico

Remittances have unique properties compared to other financial sources as they react resiliently during economic downturns and have become theorized as a tool for sustainable community development. This paper examines how remittances influence sustainable community development in small villages and towns by analyzing workers' remittance income from Texas to households in Jalisco, Mexico. The analysis will consist of comparing rates of remittance flows during the past two global recessions to understand how the current global recession induced by COVID-19 is impacting remittances differently. To understand how remittances, influence sustainable community development, the paper will assess current literature and history recorded. The hypothesis is that the recession caused by COVID-19 will severely impact the livelihoods of migrant workers in destination countries as well as families and communities reliant on remittances in home countries.

Research Mentor: Larry Hufford, Ph.D.

13 Adrianna Mirabal

Unconventional Darkness in Popular Music: Beethoven to Billie Eilish

Billie Eilish and her brother Finneas O'Connell wrote Everything I Wanted following a dream Eilish had about jumping off the Golden Gate Bridge followed by a dark and uncomfortable conversation with her brother regarding her thoughts of suicide. Eilish's 2021 Record of the Year displays intense themes of darkness and yearning; a feature of popular music that is uncommon. She is countlessly critiqued that her music is "too dark" or "too emotionally graphic" as she introduces dark mental images in her genre. However, Eilish is not the first to write dark music and have it been successful. Her popularity in this musical sphere is similar to that of Ludwig van Beethoven during the Classical period. Beethoven's Piano Sonata No. 8 in C Minor, II. Adagio Cantabile Op. 13, also known as Sonata Pathetique, emotes a delicate darkness that, during his time, was also an uncommon theme for music. In my research, I will focus on the innovative features of both pieces, their popularity over time, their unconventionality with the theme of darkness, the similarities and differences regarding their message, and their overall influence on popular culture. The essence of both Beethoven's classical piano sonata to Billie Eilish's lyrical ballad holds an overarching theme of unconventionality that connects a deep message to the popular culture of that period...

Research Mentor: Alicia Tait, Ph.D.

14 Arturo Canchola

Characterization of Mental Health Factors and Presidential Performance

Speculation of a president's mental fitness to hold office has been a subject of interest in the U.S. since the Goldwater Scandal and has risen to prominence following the 2016 U.S. presidential election. This project aims to examine the extent to which mental health factors affect presidential performance. Performance inventories from C-SPAN and Siena were compiled alongside more objective measures, such as the percentage of the popular vote won. This data was compared to psychohistorical measures of presidents, which included estimated IQ, whether they fit within DSM-IV criteria for a diagnosable mental health disorder, and scales for three forms of narcissism. Preliminary findings suggest psychiatric disorders do not significantly affect a president's overall performance, but cognitive factors like intellectual brilliance can impact performance in more nuanced ways. These findings can provide further insight for the debate around mental health and fitness for office, in the context of the 25th Amendment.

Research Mentor: Arturo Vega, Ph.D.

15 Angela Perez, McNair Scholar

Colonias: A study of infrastructure disparities in South Texas counties and their effects on education levels

Along the U.S. Mexico Border of Texas, there is a variety of socio-economic communities that are home to a diverse population. In the Rio Grande Valley, this population is predominately Hispanic with strong roots on both sides of the Rio Grande River. In efforts to further develop the region, the State of Texas began to categorize low socio-economic communities defining them as colonias. According to the Texas Attorney General's website, a colonia is defined as, "A substandard housing development, often found along the Texas-Mexico border where residents lack basic services such as drinking water, sewage treatment, and paved roads." These services are everyday necessities that impact all other aspects of a resident's life, from their health to their future education. The purpose of this study is to identify the disparities in necessary infrastructure across communities classified as colonias and to demonstrate the effects these disparities have on the level of education colonia residents reach. The Rio Grande Valley is one of the fastest growing regions in the United States. In order for further development to occur, the region must change its response to low socio-economic communities and the challenges these residents face. Historically, Texas has initiated legislation to combat the poor living conditions of colonias, however, no program has been successful in tackling the root of the problem in an effective manner. It is important to study the development of colonias and educational accomplishments of their residents because it is the starting point of bettering the region as a whole. In this study, rather than focusing on a specific piece of legislation I will look at

the demographics of the region by school districts in attempt to find a correlation between the number of colonias in the region and education levels reached by residents.

Research Mentor: Larry Hufford, Ph.D.

16 Kaitlynn Moody

Reforming the Household of God: Motherhood as a Biblical Metaphor with US Contemporary Interpretations

This project examines Catholic Christian reception of metaphorical language about pregnancy, mothers, and motherhood in the New Testament Pauline literature. With the help of contemporary case studies the project explores how changed social and cultural contexts affect interpretation of the biblical metaphors. It begins with a discussion of the New Testament images and their historical context, highlighting the ways Paul responds to issues in his own first-century setting. Followed by modern case studies highlighting different relationships with the metaphor of motherhood as seen throughout the stages of pregnancy and childbirth. We seek to demonstrate that interpreters in today's Catholic church can create more spaces for adapting their readings of the Pauline texts to be more responsive to contemporary situations and needs.

Research Mentor: Allison Gray, Ph.D.

The Social Sciences

Psychology

17 Samantha Bonillas Gabriella Rivera

Observing Social and Play Behaviors in Adult Belugas (Delphinapterus leucas) in Managed Care

Beluga whales are known to be highly social animals and have shown a wide variety of behaviors that have been recorded in previous studies. Few studies have focused on the behavioral comparison of adult beluga whales, specifically on social and play behaviors. For this study, two female beluga whales (Delphinapterus leucas), ATL and PRL, who were born in managed care, were observed to examine their social, play, and vocalization behaviors. One-minute instantaneous sampling was used to code 32 archived video recordings from 2019-2020 that ranged from 15-20 minutes each. The beluga whales' behaviors were coded using the following four categories: swim behaviors, social behaviors, play behaviors, and vocalizations. The results suggested that ATL engaged in more solo float and play behaviors than PRL, and PRL solo swam more frequently than ATL. The results also suggested that ATL engaged in more water play and vocalization behavior than PRL, but both belugas displayed similar amounts of object play behaviors. Overall, the behavioral comparison of ATL and PRL were mostly different. ATL preferred to solo float, vocalize, and water play. PRL preferred to solo swim; however, both had shown similar object play behaviors. Although beluga whales are known to be social animals, female belugas tend to be less social than male belugas. The study showed that ATL and PRL's preference for solo behaviors is not uncommon, and it aligns with what other studies have suggested. This knowledge can enhance an understanding of individual differences in female belugas, which may be critical for managed care.

Research Mentor: Heather Hill, Ph.D.

18 Phoebe Dickinson-Land Shalini Venkat

Sex disparities within Autism Spectrum Disorder genetics literature: A systematic review

Recent studies have reported the need for more females in Autism Spectrum Disorder (ASD) research studies to minimize sex biases (Halladay et al., 2015; Loomes et al., 2017). This need is especially great for biology focused ASD studies, as previous research within the field has failed to reach a consensus regarding the cause of sex differences in ASD prevalence rates (Ferri et al., 2018). To investigate this further, the current review explored the male-to-female ratios of peer-reviewed ASD literature involving chromosomal microarray analysis (CMA). Our search within databases through EBSCO Discovery

Service identified 132 relevant articles based on the articles' titles, of which 16 empirical studies were selected for full review as they met the inclusion criteria (i.e., human-subjects with ASD in their samples, reported on sex demographics, and used CMA as a genetic test). The full reviewed articles were conducted within 11 countries and male to female (M:F) sex rations ranged from 1.41:1 to 9:1. Most of the studies (87.5%) identified genetic variants related to ASD. According to extant literature, high M:F ratios in ASD literature may stem from genuine biological differences between males and females who have ASD or the underreporting and underdiagnosing of females with ASD (Beaudet, 2013; Halladay et al., 2015). Research related to genetic testing can have major implications for the diagnoses and treatment of ASD. Furthermore, the findings of this review demonstrate the need for equitable sample compositions to ensure autistic females receive the same standard of care and exploration as their male counterparts.

Research Mentor: Jillian Pierucci, Ph.D.

19 Tiffany Garcia Isabella Torres Karina Hernandez

Observing Object Play Behaviors in Beluga Whales (Delphinapterus leucas)

Beluga whales have been categorized as very playful creatures that typically engage in affiliative interactions and object play. The flexibility of objects, as well as sex and age differences in play, are important factors that can be evaluated. The purpose of this study was to assess the differences in how belugas engage in object play regarding sex and age differences and object flexibility. The subjects included 20 belugas of various ages who were located at the SeaWorld San Antonio. Data were collected from 37 hours of observations and coded for object play behaviors. As hypothesized, female calves had longer lasting sequences than male calves. Object flexibility did not affect the number of actions performed by the belugas. Younger belugas displayed less behaviors with buoy balls than older belugas. In summary, belugas of all ages display creative and diverse object play behaviors. This study is important because it further explores beluga creativity behavior in object play.

Research Mentor: Heather Hill, Ph.D.

20 Jacy Hornsby Carla Flores

Correlation Between Students with Disabilities in the Public School System and Household Income by Zip Code in Texas

Public school students facing a disability encounter major challenges that prevent the majority of them to stay enrolled in school, which are seldom addressed in research.

Previous research has examined the achievement gap that surrounds students with disabilities as well as how funding impacts school disability services in the public school system. These former studies are limited because they have not taken into consideration possible ties between regional income and enrollment rates. Study A examined if there is a correlation between mean district income and students with disabilities enrollment rates in Bexar County, Texas public school districts. Study B intended to demonstrate the correlation between public high school students with disabilities' retention rates and high and low household income by zip code in Texas. The focus of Study B was to discover if public high schools belonging to low household income zip codes would have the lowest retention rates for students with disabilities. Both Study A and Study B analyzed data from the Texas Education Agency data reports, Zip Atlas median household income databases, and from the Texas Tribune. Each study implemented a Pearson correlation and a simple linear regression. Study A's results indicate that there is a negative correlation between district mean income and students with disabilities enrollment percentages. The findings of Study B suggest that public schools belonging to high household income zip codes have lower retention rates for students with disabilities.

Research Mentor: Rick Sperling, Ph.D.

21 Joel Reyna Irene Sandoval Carmen Lopez Rosario

Are Killer Whales from San Antonio & France More Creative than Bottlenose Dolphins from Roatan?

Cetaceans, such as killer whales and bottlenose dolphins, demonstrate creative behaviors in foraging, play, and interactions with trainers. Few studies have explored their creative ability. This study examined the creative differences between killer whales and bottlenose dolphins and assessed the effect of location on killer whale creativity. A rating scale was used to measure the creativity demonstrated by four killer whales from MarineLand of France, five from SeaWorld San Antonio, and eight bottlenose dolphins from the Roatan Institute of Marine Sciences. Results showed that, on average, bottlenose dolphins displayed significantly higher rated behaviors on the creativity scale than killer whales. However, killer whale creativity is not impacted by location. This study suggests that both species are uniquely creative and capable of producing combinations of behaviors that may help these species to find solutions to challenging situations. This study contributes to research efforts that aim to explain and understand intelligence in non-human animals. It emphasizes the need for further research into cetaceans' creative capacities, which can lead to increased understanding of their cognitive functioning and potentially play a valuable role in species conservation efforts.

Research Mentor: Heather Hill, Ph.D.

22 Wendy Ornelas Brandon Torres Maria Ruda

Social and Play Interactions for Three Beluga Calves (Delphinapterus leucas)

A Cook Inlet beluga calf was stranded in September 2017 near Alaska at an estimated age of one month. The calf was rehabilitated in human care 24 hours a day for six months until he was deemed non-releasable and transferred into the care of SeaWorld San Antonio. The purpose of the current study was to compare the social interactions of this stranded and non releasable calf to two calves of similar age. Instantaneous sample points across a 5-min session were collected hourly 5-7 days per week for the focal calf and his companions from April 2018 until March 2019. In the current study, archived data footage and ethograms were utilized for three beluga calves (TYO, INK, KEN). This research study investigated factors such as social, play, and swim behaviors that could have an influence on the calves. Results for social behaviors consisting of affiliative, aggression, and socio-sexual showed no significant increase with time. INK, KEN, and TYO continued to perform social behaviors at similar levels over time. The variables of motor play, aerials, object play, and bubble streams were collapsed into an overall play category. Play behaviors between calves were similar in proportion over time. Similarly, solo swim behavior and swim with other did not change over time for any calf. However, while TYO decreased solo floats over time, KEN increased solo floats over time. In summary, our study showed that there are more similarities between the calves and time had minimal effect. This research suggests that peers of similar age are important for behavioral development.

Research Mentor: Heather Hill, Ph.D.

23 Marina Castro Ramos

Appropriate Presuppositions in Children's Literature at the Preoperational Stage of Cognitive Development

Children's literature seeks to develop a child's creativity and emotional intelligence, nurturing the growth and development of their persona (Crippen 2012). Jean Piaget defines cognitive development into four stages. The second stage, the Preoperational Stage, examines children's cognitive development at ages 2-7. During this period, children develop symbolic thinking, proper grammar to express concepts, and conservation. At this point, their thought is egocentric and their ability to understand complex and abstract thought remains difficult (Malerstein & Ahern, 1979). Presuppositions can be semantic or pragmatic. A semantic presupposition is included in an utterance or phrase that remains true even if the utterance is negated. A pragmatic presupposition is something that is implied by the utterance (Mooney & Evans, 2019). The current study examines if presuppositions in children's literature at their preoperational stage of cognitive development are appropriate. The current study analyzed the text A Chair for My Mother by Vera B. Williams to investigate whether the literature children are exposed to is

appropriate for their cognitive stage. The Sapir-Whorf Hypothesis indicates that in some aspects of linguistic diversity, different languages represent the world differently. This has consequences for how people perceive reality and think about the world (Mooney & Evans, 2019). For a child, it is especially detrimental to be exposed to language they understand. Simultaneously, it is crucial that they are exposed to new concepts and challenged within their capabilities.

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

24 Alexandra Guerra

Cinematic Portrayal of Antisocial Personality Disorder and Psychopathy: Is it accurate?

Popular media may misrepresent the construct of mental illness, which has been found to cause the formation of false opinions about psychopathy. Findings show that increased exposure to fictional characters portraying psychopaths has left laypeople feeling like they have greater expertise on the construct. The gap in current research lies within character portrayal and its alignment with current measures of psychopathy. For example, only six characters from a sample of 30 movies actually met the criteria to be classified as a psychopath using the PCL-R. The current study aimed to examine the accuracy of movie portrayal for the construct of psychopathy through a diagnostic lens. Using both the PCL-R and the DSM-V criteria for Antisocial Personality Disorder (APD), 18 characters from 18 movies were evaluated for their congruency with clinical diagnoses. By the standards of DSM-V criteria for APD, coding for only two characters warranted a diagnosis of APD and by standards of the PCL-R, no character qualified for a diagnosis of a psychopath. Implications of these findings indicate that misrepresentation of psychopathy in popular media may affect the future of psychological diagnoses and legal outcomes.

Research Mentor: Heather Hill, Ph.D. and Jennifer Zwahr-Castro, Ph.D.

OL Brendan Brown Ashley Dozier Karla Salazar Sara Kamal

Gender Differences in Hedge Word use in Political Discourse

Hedge words are words used to soften a statement. The goal of this study was to find a correlation between gender and the use of hedge words throughout the 2020 democratic debates. Previous research shows that women use more hedge words than men; however, there are conflicting theories. This research hypothesised that men would use more hedge words in the 2020 Democratic debates. From the data that was collected, there is no significant difference in gender and use of hedge words throughout the debates. Hedge words are crucial in usage, they can completely change the attitude of a statement.

Research Mentor: Jennifer Zwahr-Castro, Ph.D.

OL Sequoia Callahan, McNair Scholar Bridget Horta

Ecologically Plausible?: Comparing the Independent and Paired Samples t-test with non-Random Missingness and Skewed Data

Missing data often presents difficulties for educators seeking to establish the potency of an intervention using a pre-test/post-test design. These problems are exacerbated in settings when high student turnover seriously depletes sample size and reduces power. Previous research has shown that the independent samples t-test outperforms the paired-samples t-test when there is high missingness and a low correlation between pre-test and post-test scores (Marquez-Munoz, 2019; Sperling, Zwahr-Castro & Walls, 2017). In this study, we demonstrate that the independent samples t-test maintains its advantage to the paired samples t-test when data are skewed, which often happens when a large proportion of students do either very well or very poorly on the assessment. Implications for educators in districts with high student mobility are discussed.

Research Mentor: Rick Sperling, Ph.D.

OL Megan Copeland Azucena Cuevas

Does Your Attention to the Media Influence Who You Vote For?

The present study approaches engagement in terms of viewing the days and average attention during the week people watched political media on television, newspaper, and internet. It incorporates different outlets to find which is the most successful and uses them to predict the candidate choice for the 2008 and 2016 election year. Previous research has only focused on one central outlet and using several can show which are the most successful in delivering campaign news, and that people rely on more than one outlet for news. The first hypothesis for this research study was watching the political media between 5-7 days a week will produce a stronger likelihood of voter's attention to the news predicting who they voted for than watching the news between 1-4 days a week. The second hypothesis was the most significant outlet for political media will be television.

Research Mentors: Rick Sperling, Ph.D. and Jennifer Zwahr-Castro, Ph.D.

OL Micaela Cruz, McNair Scholars

Mexicanidad on the Westside: Tracing the Legacies of Incomparable "Servingness."

The Hispanic-serving Institution (HSI) designation is a statistical-based identity given to colleges and universities with a 25 percent or higher Latinx student population. HSIs are eligible to receive federal funding based solely on that designation, however, there are no definite guidelines to ensure that the money is spent in a culturally responsive manner. Our Lady of the Lake University (OLLU) continues to provide high quality education to their Latinx students. In this presentation, we traced historical events that influenced OLLU to develop a Latinx-conscious identity and then compare their institutional behavior to that of another university located on the Westside of San Antonio: St. Mary's University (StMU).

Research Mentor: Rick Sperling, Ph.D.

OL Isabella De Paolo

Attachment Behaviors and Social Development in a Child with Autism Spectrum Disorder

The current study examined a toddler with moderate autism spectrum disorder (ASD) and his caregiver during participation in a structured early intervention program (Project ImPACT). The study examined how the intervention influenced the child's social engagement and attachment behaviors. Researchers hypothesized that attachment and social engagement behaviors would increase from baseline to intervention, and that they would positively correlate. The study examined attachment behavior by classifying the child's proximity to and response toward the caregiver. The child's physical and verbal actions were used to code social engagement. A Pearson product moment correlation revealed a significant correlation between attachment and social engagement, r=.545, p=.036. Simulation Modeling Analyses showed a rise in child's attachment (i.e., proximity, p=.08) and social engagement from baseline to intervention, though not statistically significant (p=ns). The study confirmed previous research suggesting that children with ASD can have secure attachment behaviors and experience benefits, such as increased social engagement.

Research Mentors: Rick Sperling, Ph.D.

OL Lyzette Flores

Gender Differences in Pet Attachment

Pets are a source of love, a fundamental source to humans- forming deep connections. This study focused on gender differences among pet attachment in undergraduate students. Previous studies have shown females scoring higher on Pet Attachment Scales (PAS), however for the purpose of this research, a questionnaire was utilized instead. The current

studies results' demonstrated females scoring higher, however males might have been affected due to the disproportion of the sample size. Future research should emphasize on equivalent sample sizes along with other scales. Since many individuals own a pet, it is important to investigate who is more attached.

Keywords: pet attachment, gender differences, undergraduate students, females, males

Research Mentor: Rick Sperling, Ph.D.

OL Maria Martinez

Using a correlational method of analysis to investigate the relationship between civic engagement and attitudes of trust towards local government officials.

The present experiment was designed to test if relationships exist between civic and political participation and feelings of trust towards local governments. This experiment was modeled using a correlational form of analysis where multiple variables were compared to form a multiple regression model using the statistical program, R. The purpose of proposing this experiment was to bring to light the different variables that may play a role in the ever-growing sense of divide and mistrust between public officials working within the vast American government and its citizens. This is a widely researched area due to the great array of implications posed on a national and individual level. A previously conducted study proposed the implication that trusting and having positive beliefs about your government are vital in creating and maintaining the ideal democracy (Oosterhoff, B.; Kaplow, J.; Layne, C.M., & Pynoos, R.S. 2018). Another study proposed the concept that trust, and civic engagement are psychological variables that do indeed affect the confidence citizens have towards governments and institutions (Brehm J.; Rahn W. 1997). Limitations in the current and many previous studies lies in the variation that follows the use of large, varied sample sizes such as those used in surveys. Many experiments that have tested these concepts of trust and political participation have used public survey questionaries such as the American National Election Studies-ANES, in this experiment the public data collected by the University of Chicago known as the GSS-The General Social Survey was used. The results of this experiment indicated that there was a significant correlation between trust in the local government and feelings of influence on local governments, interest in politics, and local voting participation.

Keywords: political participation, civic engagement, trust towards government, voting

Research Mentor: Rick Sperling, Ph.D.

OL Andrew Magee, McNair Scholar Amilynn Campa Isabella Hughes

Extent of Statistical Power in Skewed Distributions with Nonrandom Missingness

Low socioeconomic status (SES) students have considerably higher school mobility during the school year. Moving in the middle of the school year leaves missing data for their scores, which leads their need for academic assistance to go overlooked by educators (Welsh, 2016). Though proper statistical treatment of students' test scores requires the use of a repeated measures ANOVA (RMA) the one way ANOVA (OWA) has yielded less error with data with high missingness (Callahan, 2020). Missingness must be corrected for in RMA, which requires that the groups have equal sample sizes, and all methods of correction or avoidance of missingness have serious problems and have thus far been unable to outperform the OWA, producing higher error rates than the OWA. The current study aims to continue the work of Aquino Aguilar (2017) and Callahan (2019, 2020) by comparing the performances of the OWA and the RMA with skewed distributions and missingness not at random (MNAR) with various mean differences, skews, and levels of missingness using a Monte Carlo simulation. Type I and II error and statistical power were compared between the OWA and the RMA, accounting for the MNAR using listwise deletion (LD) across the conditions. The RMA was found to outperform the OWA in several cases, most frequently with data with high missingness.

Research Mentor: Rick Sperling, Ph.D.

OL Kayla Mendez

Gender Differences in Academic Stress Levels

College students are vulnerable to all types of influence, which can lead to the development of detrimental behaviors. Previous research has analyzed stress patterns in higher education, but sex was rarely included as a main variable. This study provides insight into the affect sex has on students' mentalities, specifically the perceived amount of academic stress endured throughout a semester. The current study's results displayed no main effect between sex and academic stress levels, and no interaction effect between sex and education status level, possibly due to the lack of sample size and various biases introduced. Therefore, future studies should focus on highlighting specific stressors that impact sexes differently, and how different majors view certain stressors.

Research Mentor: Rick Sperling, Ph.D.

OL Ivanna Rodriguez Gabriela Vargas

Analyzing the Presence of Gender Stereotypes in Children's Toy Commercials

Toys convey powerful messages about female and male gender roles. Previous research has analyzed and revealed that toys and their advertisements are highly gender-specific. Children engage in gender-specific toy play to a greater extent than in non-gender specific toy play leading to different developmental trajectories for boys and girls. (Weisgram 2014; Owen 2015) Ads may provide children with models of how they should look, behave, and interact with others. Multiple findings have shown the content involved in children's commercials tend to exaggerate traditional gender stereotypes. Generally, toys advertised towards girls have themes of nurturance and cooperation, focusing on appearance and attractiveness. Toys advertised towards boys focus on themes of aggression, competition and action. Past research has analyzed gender stereotypes such as the type of interaction present, the type of play the toy promotes, and the colors involved in commercials aimed at specific genders. (Larson 2001;Kahlenberg 2009) The purpose of this study is to further examine if gender stereotypes are present in children's toy commercials. Therefore the study will analyze if there is a relationship between the gender and the presence of gender stereotypical indicators in toy commercials. Toy commercials that advertise darker colors, dominant interactions and types of play such as fighting, playing the hero are expected to be advertised toward males. On the other hand, toy commercials that advertise lighter colors, individual or calmer interactions and types of play such as nurturing, fashion are expected to be advertised towards females.

Research Mentor: Rick Sperling, Ph.D.

Greehey School of Business

Finance and Risk Management

OL Zyania Seijas, McNair Scholar

Mexican Remittances and the Effect of Financial Uncertainty

This research investigates the extent to which Mexican workers' remittances are affected by the financial conditions and economic policy uncertainty in the United States. The United States accounts for about 90-95% of all remittances sent globally to Mexico on a yearly basis. Over eight thousand million dollars have been sent to Mexico every year, for the past ten years. This study helps analyze the effect of the American economy on remittances to Mexico. Results from a multivariate model reveal that a positive effect on financial conditions index, a measure of the United States financial stress, will have an increase in remittances from the United States to Mexico. But on the other hand, economic policy uncertainty, which measures three underlying components: quantifies newspaper coverage of policy-related economic uncertainty, reflects the number of federal tax code provisions set to expire in future year, and uses disagreement among

economic forecasters as a proxy for uncertainty, has no real effect on remittances. This analysis of the financial conditions, economic policy uncertainty, real exchange rate and housing starts in the United States and its effect on remittances from workers outside of Mexico shows that the relationship between the American and Mexican economy are closely related.

Research Mentor: Violeta Diaz, Ph.D.

School of Science, Engineering and Technology

Biological Sciences

25 Andrea Benavides, MARC U*STAR Savannah Berger, MARC U*STAR Nathaniel Liendo, Biaggini Scholar

Can Snake Venoms Combat our Antibiotic Resistance Problem?

Treatment against bacterial infections is a forefront issue that reigns strongly among our advanced society. Antibiotic-resistant bacteria are an imminent threat to the safety of the public. Pathogenic bacteria are known to be transmitted via many routes such as water, air, food, and living vectors which thus accelerate their spreading potential and give rise to many different diseases. Many of these pathogens develop resistance to antibiotics that are widely used. Even more worrying, few therapeutic alternatives exist for multidrug-resistant bacterial pathogens. Using snake venom has recently been a forward-thinking solution to this issue. Snake venoms contain many different bioactive enzymes that can be exploited to treat human diseases. This propelled our research into characterizing the antibacterial properties these snake venoms held. Venoms from six different snake species were examined for their antibacterial properties through the use of a Kirby-Baur dish infusion assay. Multiple dilutions of each venom were tested against multiple bacterial species and measurements of zones of inhibition were noted in order to evaluate the potency of their antibacterial activity. Two venoms have thus far shown measurable antibacterial activity against two different bacterial species (Bacillus cereus and Bacillus subtilis). The future for this research is to then identify and isolate the antibacterial components which allow antibacterial efficacy.

Research Mentors: Jesus Segovia, Ph.D. and Veronica Contreras-Shannon, Ph.D.

26 Rachael Dargan Jose Saavedra

Effect of Crizotinib of ALK transfected Ewing Sarcoma Cells

Ewing Sarcoma is a rare cancerous tumor that primarily targets the bones and surrounding areas. Only a small portion of the population is affected by Ewing Sarcoma but the cancer can spread quickly and affect other parts of the body leading to death. By itself, Ewing Sarcoma has a high rate of survival, causing it to be a good candidate for drug testing for cell proliferation. For this experiment, the treatment plan will include treating the cells with Crizitonib as the inhibitor alone and in combination with siRNA. This will be followed by

RNA purification, cDNA synthesis in order to create a good template for this gene expression study, and qRT-PCR to observe changes in the gene expression in ALK. Alamar Blue Assay and Cytotox Assay are used to determine cellular proliferation changes and observation on cells resulting in apoptosis. Thus, if the proliferation of Ewing Sarcoma is caused by ALK mutations then, treating the cell with Crizotinib will stop cell proliferation in the cancerous Ewing Sarcoma cell. The data collected from the qPCR was used to determine changes in gene expression. qPCR determined the number of genes present within the cell at the time of measurement. The data from qPCR indicated that there was a 96.22% prediction in the ALK gene following knockdown with siRNA. Gene expression increased by 2.37 fold when the drug was added. When siALK knockdown correlated with INSRB receptor, there was a 99.88% reduction, with a slight increase in expression when Crizotinib was added. SOX18 expression increased when the drug was added with a 90.38% increase. The results concluded that the drug Crizotinib decreased cell proliferation but did not increase cell toxicity. Levels of cell proliferation in siALK decreased by 23.35% compared to siControl cells. The addition of Crizotinib to siALK cells showed a 30.29% decrease in proliferation. Our initial hypothesis was supported which proves that further exploration with this experiment should be done in order to reach a more accurate conclusion.

Research Mentor: Terry Shackleford, Ph.D.

27 Rachael Dargan, Spring Research Fellowship

RU486 binding affinity with ERBeta, ERAlpha, acERBa in Teleost Fish

Estrogen receptors (ERs) are activated through the binding of estrogens to facilitate the transcriptional activity of certain genes. There are three ER subtypes in teleost fish: ERalpha, ERBa, and ERBb. The antiprogestin mifepristone (RU486) binds to acERBa, but not to ERalpha or ERBb. The affinity of RU486 to an ER is surprising since its mechanism of action is via binding progesterone receptors in early pregnancy as an abortifacient. This unusual binding affinity may be due to the presence of diagnostic amino acid changes in the ligand-binding domain (LBD) of ERBa. To investigate the role of the diagnostic amino acid changes in the LBD of ERs, we have used reciprocal mutant ERs in competitive binding assays to determine their individual contribution to RU486 binding properties. This project will compile, synthesize, and statistically analyze this large data set to create an overall picture of ERBa:RU486 binding interactions. This analysis will inform our future experiments investigating the role of the ERBa diagnostic amino acids present in its unique binding affinities to estrogens and estrogenic drugs. Determining how an estrogen receptor binds to a ligand can provide better information on how to regulate the hormones and their expression in humans, in the future.

Research Mentor: Mary Hawkins, Ph.D.

28 Giselle Garcia Ty Jungman Alondra Rodriguez Jack Ojile Durlin Uridan Valle

Cell Viability in Rhabdomyosarcoma Cells Using the Knockdown of FGFR4 and Treatment with Roblitinib and Picropodophyllin

The most common soft tissue cancer among children is Rhabdomyosarcoma (RMS); this cancer can be caused by the mutation and/or fusion of various genes within a cell. The most common mutations that cause RMS involve Fibroblast Derived Growth Factor Receptor 4 (FGFR4), Insulin like Growth Factor Receptor 1 (IGF1R), and p21. Both FGFR4 and IGF1R are known to inhibit regulators of the cell-cycle when activated. When these genes are not being over expressed, p21 is allowed to regulate the cell cycle and activate apoptosis in mutated cells. Therefore, if IGFR1 and FGFR4 activation inhibit cell-cycle regulators, then the inhibition of IGFR1 and FGFR4 will activate p21 causing cell-cycle regulators to activate apoptotic pathways. Through the creation of cell cultures, the transfection of siFGFR4, and the use of qRTPCR, the viability of the cells could be determined using AlamarBlue and Cytotox assay. The drugs used to inhibit IGFR1 and FGFR4 were Roblitinib and Picropodophyllin (PPP). The usage of PPP reduced cell proliferation by 1%, and the use of the knockdown of FGFR4 reduced cell proliferation by 19%; however, the use of PPP combined with the knockdown of the FGFR4 gene provided results that deemed the treatment very effective with an inhibition of cell proliferation by 87%. Treatment of the gene using the siFGFR4 transfection without any drugs led to an increase in the viability of the cells within the culture. The combination of inhibiting the FGFR4 and IGFR1 genes using the knockdown gene and treatment of PPP synergized well in inhibiting the cell signaling pathway, allowing p21 to function, and preventing any mechanisms of resistance that could have arisen.

Research Mentors: Terry Shackleford, Ph.D.

29 Lorelie Gonzalez, Spring Research Fellowship

Tubulin Network Differences Between Differentiated and Undifferentiated Bone Marrow-Derived Macrophages

Bone marrow-derived macrophages (BMDM) from mice are highly specialized cells that are able to differentiate into foam cells upon the uptake of lipids. This mechanism is visualized in atherosclerosis as macrophages containing cholesterol lead to the formation of plaque seen in people with high levels of bad cholesterol better known as low-density lipoprotein (LDL). Recognizing that atherosclerosis can lead to a heart attack, stroke, or even death, it is essential to study the mechanisms of this disease. Specifically, how foam cells differentiate and how their tubulin network adjusts upon differentiation.
The aim is to culture BMDM cells for 7 days, plate them on the seventh day in a 24-well dish on top of coverslips, and incubate them overnight to allow cells to recover from being lifted. They will be treated with lipopolysaccharide (LPS) and both LPS and LDL to observe the differences between differentiated and undifferentiated macrophages. Then, live cell staining for lipid will be performed on the third day along with cell fixation using formalin ending with the permeabilization of cells and blocking of coverslips. The application of primary and secondary antibodies will proceed as well as mounting coverslips onto slides to image for DAPI and LipidSpot488. The use of antibodies to different treatments is performed in order to ultimately observe differences between isotypes of beta-tubulin I and anti-alpha-tubulin 1A, both from mice, via immunofluorescence. Results will differ, but it is expected to observe differences as differentiated macrophages (foam cells) will have a more complex tubulin network than undifferentiated BMDM cells due to the addition of LPS and LDL which cause the macrophage to expand based on the fat deposits.

Research Mentor: Veronica Contreras-Shannon, Ph.D.

30 Jacqueline Mendez, Spring Research Fellowship

CAM Assays and angiogenesis

Chick Chorioallantoic Membrane assay, CAM assay was developed in 1912 and is one of the earliest animal models that are primarily used to grow tumor grafts. Recently 3D "in vivo" has become a very popular model for many malignancies. Because of its rich vascular network, CAM assay makes a very good model specifically for tumor angiogenesis and antiangiogenic compounds. The method is highly efficient and cost-effective while also lowering the ethical concerns of using mice for angiogenesis studies. CAM assays are performed on fertilized chicken eggs, that are incubated for 4-6 days with 70% humidity and a temperature of 37.6 degrees Celsius. Then, a small opening on the egg is made with a drill once the air sac is located. Tumor cells can be implanted directly into the egg and treated with various drugs. Using imaging with a stereomicroscope, angiogenesis can be quantified by manually counting the number of blood vessels arising from the tumor cells. We describe the use of this method as a useful experiment for the analysis of angiogenesis of tumor cells. This method can be used to determine the effect of potential drugs or proteins on the angiogenesis process and even in metastasis in classroom and research studies.

Research Mentor: Terry Shackleford, Ph.D.

31 Aranza Morales Hector Bayaborda Christopher Dunn Amanda Tran Cristianna Tovar

Effects of Crizotinib on Gene Expression of SOX-18, ALK, and PDGFRB in Ewing Sarcoma Cells

Ewing Sarcoma is a malignant bone cancer with the capability to take up to 70% of the lives of many children/young adults diagnosed every year. Since much still remains to be discovered about Ewing Sarcoma, we tested Crizotinib, an inhibitor for both Anaplastic Lymphoma Kinase and ROS1 (oncogene), to study the use of highly specific drugs targeting signaling pathways and reducing cell proliferation. We hypothesized: If Ewing sarcoma cells were exposed to the Crizotinib drug, the expression of the ALK, SOX18, and PDGFRB genes would decrease. We expect the drug to be toxic to the cells, increasing overall cytotoxicity and decreasing cell proliferation. We transfected our cancer cells with the siRNA and Crizotinib. The cell lysate was collected and RNA was extracted before undergoing qRTPCR. The genes tested produced an observable percent reduction in gene expression. There was not enough usable data collected for PDGFRB and SOX-18 to conclude the %KD of these genes. However, the si target gene ALK successfully yielded a KD of 86.77% according to the results of the qRTPCR. Despite the ALK producing a %KD of 86.77 and increased cytotoxicity, its gene expression fold appeared to increase by +1.38, which likely arose as a false readout due to source of error. The conclusive results gathered suggests that while Crizotinib was successful in down regulating expression of cancerous genes found in Ewing Sarcoma, further research of treating Ewing Sarcoma should still inquire looking into drugs more suited for this cancer.

Research Mentors: Terry Shackleford, Ph.D.

32 Elysandra Solis, McNair Scholar

Identifying Effective Drug Treatments of Receptor Tyrosine Kinase Targeted Inhibition in Ewing's Sarcoma and Rhabdomyosarcoma

Treatment of pediatric sarcomas has in recent years captivated researchers to combat these rare diseases through in vitro studies that would then be evaluated for clinical trials. The importance of these in vitro studies stems from the rarity of these cancers, with diagnosis being low and prognosis being poor the importance of these in vitro studies is heightened to allow for a thorough prediction of how inhibitors will affect the targeted cancer cells, which would allow for a clinical trial to take place. The sarcomas focused on in this paper are Ewing's Sarcoma and Rhabdomyosarcoma, both of which are pediatric sarcomas that respectively affect the bone and soft tissue of its host. The Ewing Sarcoma cell lines observed were BRD4, CDK4/6 and FGFR all displaying an acceptable inhibition with their respective inhibitor drugs at concentrations of 100-1000 nM. Focusing on the results of

the most influential gene, it was inferred that CDK4 and sister gene FRS2 should be observed for future in vitro work and further clinical trials. As for the Rhabdomyosarcoma cell lines observed, which were RD, RH30, RH41, RH36, three different inhibitors were used alone and with TZ1 to observe the effect the addition of TZ1 would have on cell survival. The pronounced effect was observed through comparison of IC50 values with and without the TZ1. Understanding the effects these inhibitors have on these various cell lines will allow for implementation of clinical trials that could eventually improve the vitality of patients with Rhabdomyosarcoma and Ewing's Sarcoma.

Research Mentor: Terry Shackleford, Ph.D.

33 Jordyn WraySanaa AbidPaul ElbayehTimothy Tran

The Evaluation of ALK Expression in Ewing Sarcoma with Crizotinib

Ewing Sarcoma is one of the most prevalent pediatric bone cancers and is caused by a translocation mutation between chromosomes 11 and 22. Ewing Sarcoma commonly develops in bones but can be found in the soft tissue surrounding the bones. Ewing Sarcoma is usually found in children and can metastasize to the lungs, bone marrow and other major bones. The focus of the study was on the gene, ALK (Anaplastic Lymphoma Kinase), which is involved in cell signaling and proliferation. ALK mutations have proven to be a challenge to treat due to the cellular responses that occur from the mutation. Crizotinib is a widely used chemotherapeutic that is utilized to treat lung cancers involving ALK mutations. While it was initially developed for c-MET (Mesenchymal Epithelial Transition) inhibition, Crizotinib has proven to inhibit ALK expression in certain cases by inducing apoptosis. In addition, the RNAi pathway can be used to inhibit the expression of ALK via siRNAs. Naturally, siRNAs are used to inhibit the expression of foreign RNAs by binding to the RISC complex and attaching to a complementary mRNA. This results in the degradation of bonded mRNA strands which leads in the knockdown of gene expression. We believe that if Crizotinib with siALK is acting on the Ewing's Sarcoma pathway, then cell proliferation rates will decrease. We obtained tissue samples and tested different combinations of Crizotinib with siALK. Crizotinib reduced cell viability by approximately 6% of the siControl when analyzed via an Alamar Blue assay. This was also found in the Cytotox assay with a reduction of living cells by approximately 30%. In addition, when using qRTPCR we observed a 45% knockdown of gene expression with Crizotinib, but a 22-fold increase with siALK. Thus, our initial hypothesis supported our data as an increase in cytotoxicity and decrease in cell viability would be expected if we inhibited ALK gene expression.

Research Mentor: Terry Shackleford, Ph.D.

OL Isabelle Bergman, MARC U*STAR

A pH Switch Controls Zinc Binding in Tomato Copper-Zinc Super- oxide Dismutase

Copper-zinc superoxide dismutase (SOD1) is a major antioxidant metalloenzyme that protects cells from oxidative damage by superoxide anions (O2-). Structural, biophysical, and other characteristics have in the past been compiled for mammalian SOD1s and for the highly homologous fungal and bovine SOD1s. Here, we characterize the biophysical properties of a plant SOD1 from tomato chloroplasts and present several of its crystal structures. The most unusual of these structures is a structure at low pH in which tSOD1 harbors zinc in the copper-binding site but contains no metal in the zinc-binding site. The side chain of D83, normally a zinc ligand, adopts an alternate rotameric conformation to form an unusual bidentate hydrogen bond with the side chain of D124, precluding metal binding in the zinc-binding site. This alternate conformation of D83 appears responsible for the previously observed pH-dependent loss of zinc from the zinc-binding site of SOD1. Titrations of cobalt into apo tSOD1 at similar pH support the lack of an intact zinc-binding site. Further characterization of tSOD1 reveals that it is a weaker dimer relative to human SOD1 and that it can be activated in vivo through a copper chaperone for the SOD1-independent mechanism.

Research Mentor: Ahmad Galaleldeen, Ph.D.

OL Belia Camarena, Honors program

Effects of inhibiting CDK4/CDK6/EWS on the Proliferation of Ewing Sarcoma

EWS, Ewing Sarcoma, is a pediatric cancer that develops from the bone marrow. Ewing sarcomas are known to have high expression of CDK4, and the EWS/FLI-1 gene is also critical in the tumorigenesis of these sarcomas. A prominent anti-tumor drug being studied is MG132 which triggers apoptosis through the formation of reactive oxygen species. The hypothesis is that EWS/FL1 has a negative correlation with CDK4 expression, and perhaps the loss of CDK4 is what allows ES cells to exist with the EWS/FL1 fusion gene. A qrtPCR test was first performed using a CDK4 and EWS/FLI-1 gene knockdown; this was done without the presence of a drug. This experiment was then repeated with the addition of MG132. An alamar blue proliferation assay was then performed to test cell viability after the knockdowns listed above and in the presence of the drugs Abemaciclib and MG132. The results partially support the hypothesis because a change in expression was seen where a loss of the EWS/FL1 gene leads to a significant increase in CDK4 expression. However, there is no clear relationship between the loss of the CDK4 gene and expression of EWS.

Research Mentor: Terry Shackleford, Ph.D.

OL Cerise Cisneros

Developing a Novel System to Examine the Effects of Vagolytic Drugs on Zebrafish Gastrointestinal Motility on male and female zebrafish ECG readings

The vagus nerve (CNX) is a part of the parasympathetic nervous system which supplies the heart, gills and digestive tract of the zebrafish. While the role of the vagus nerve in the digestive process of zebrafish is under-studied, there is evidence to suggest that the nerve has a role in gastrointestinal motility, with previous research finding that a reduction in vagal tone leads to reduced GI motility. Vagolytic, or anti chlorogenic drugs are medications which inhibit the action of the vagus nerve by blocking the action of acetylcholine on muscarinic receptors. These drugs increase the heart rate and are used to treat bradycardia in humans. While there is some limited, but contrasting research on the effect of atropine on zebrafish gut motility, the effects of other vagolytic drugs remain under-examined. The long term goal of our research is to develop a system for studying the role of the vagus nerve in zebrafish digestion. We will first establish the efficacy of vagolytic drugs using a non-invasive ECG system (iWorks) designed to measure key cardiac function parameters in zebrafish, including T and QT segment shortening and prolongation. Drugs identified as safe and effective vagolytics in the ECG screen will be used in GI motility studies. We hypothesize that zebrafish treated with vagolytic drugs will exhibit a reduction in GI motility when compared to the control. As the zebrafish is emerging as a model organism for both gut motility and vagal nerve research, this study will provide potential insight applicable to other animals.

Research Mentor: Mary Beth Hawkins, Ph.D.

OL Paul Elbayeh, Spring Research Fellowship Yairy Mendez, Spring Research Fellowship

Investigating the Ethyl Methanesulfonate Induced Changes in Motor Function with Age in Adult Drosophila melanogaster

Oxidative damage has been shown to occur in multiple organisms as they age. However, the exact relationship is still under investigation. A prominent theory that has emerged to explain this relationship is the oxidative stress theory of aging. This theory states that the production of oxidants during aerobic metabolism plays a part in the effects of aging. Because oxidants are so reactive, they can react with multiple proteins which can result in an early age-dependent death due to declines in muscle function. Specifically, oxidation can result in damage to several proteins that are required for the movement of calcium within the neuron and in turn reduces muscle functionality with age. In fact, oxidation-dependent dissociation of Calstabin has been shown to "result in reduced muscle function in the adult fruit fly"(Kreko-Pierce et al., 2016). Here, we used the Drosophila model system in order to study this relationship. Specific EMS generated mutant flies were produced and used to observe this distinction. BF-17, BF-32, and BF-12 flies were chosen because they appeared to have both decreased and improved motor function as they aged

when compared to control flies. When compared to control flies, BF-12 flies appeared to have an increase in motor function as assayed by the proboscis extension reflex (PER) and wall climbing assays. In order to more accurately determine the reason for this distinction and whether or not it relates to oxidative damage at the neuromuscular junction (NMJ), these flies were aged to 40 days and dissections were conducted in order to observe any possible morphological changes in the NMJ in the presence of these EMS induced mutations. Ultimately, this will help us to determine why the different mutant flies have varying motor function profiles as they age and give us an insight into the beneficial changes induced in BF-12 mutants.

Research Mentor: Rebekah Mahoney, Ph.D.

OL Amanda Garcia, MARC U*STAR

Characterization of Long-term Effects of Mycoplasma pneumoniae CARDS Toxin in Respiratory Epithelial Cells

Common diseases including tracheobronchitis and walking pneumonia are caused by an atypical bacteria called Mycoplasma pneumoniae. The organism is able to cause infection and survive a long time in a host, but the mechanisms in which it does so are not completely understood. One of the most important virulence factors in M. pneumoniae is the Community Acquired Respiratory Distressed Toxin (CARDS toxin). We hypothesize that CARDS toxin plays a role in mitochondrial damage. Treatments with various doses of CARDS were used to study the effects of the toxin in A549 cells and macrophages. Western blots were used to analyze the presence of CARDS toxin as it relates to the dose administered and the exposure period. Our data demonstrates an increase in presence of CARDS as dose of CARDS administered is increased. This work also suggests that CARDS experiences breaking down or processing in a cell. Altogether, the data collected contributes to understanding these mechanisms. This can be further studied to determine the exact role CARDS plays in the mitochondrial damage that results from various doses of CARDS and exposure periods.

Research Mentor: Jesus Segovia, Ph.D.

OL Christian Guerrero Joyeuse Nishimwe Caily Torres

The effects of Crizotinib on the expression of the gene PDGFRbeta of Ewing Sarcoma

Ewing Sarcoma is a malignant bone cancer that primarily targets the bones of the legs and pelvis, and the soft tissue around the bones. In comparison to 1% of all childhood cancers, its rarity fails to shadow the notorious aggression of its metastasized form. Its symptoms include increased bone tenderness and fragility, fatigue and unexplained weight loss and

swelling. Platelet- Derived growth receptor beta (PDGFR \hat{I}^2) are catalytic receptors that have intracellular tyrosine kinase activity. They have roles in the regulation of many biological processes including embryonic development, angiogenesis, cell proliferation and differentiation. In addition to the EWS-FLI-1 mutation, the platelet-derived growth factor receptor \hat{I}^2 (PDGFR- \hat{I}^2) is highly expressed in ES cells, the objective of the experiment is to reduce the expression of PDGFR beta with a combination of siRNA transfection and the drug Crizotinib in order to inhibit the growth of Ewing Sarcoma cancer cells. We believe that a combination of siRNA and Crizotinib will result in a more successful gene knockdown of the PDGFR beta gene, more than the siRNA without the drug. Two additional genes (ALK, IGFR) were used and a Housekeeping Gene (EEF1R) in order to compare the success of the siRNA and Crizotinib on various genes while the HKG served as a measure to ensure that the same amount of gene was loaded. EWS cells were plated, transfected with the drug Crizotinib. Cells were collected for RNA extraction and gene expression was analyzed by qRTPCR. The results were that the SiPDGFR without crizotinib was able to knockdown PDGFR by 65.45% which also caused ALK to be knocked down by 76.59%, but had an opposite effect on IGF IR which increased in fold expression from 1.00 to 3.88. The combination of siPDGFR beta and Crizotinib resulted in a more successful target gene knockdown of 71.45%, while AlK fold expression jumped from 1.00 to 1.35 unexpectedly, the IGF IR fold expression although still increased, was slightly reduced to 1.58 compared to the fold without the drug (3.88). Overall the results supported our hypothesis as the combination of both the siPDGFR with Crizotinib resulted in a more successful gene knockdown of PDGFR, reducing the amount of ewing sarcoma cancer cells. A connection between PDGFR and ALK was established without the drug, meaning that by simply performing a SiRNA transfection on PDGFR, one pathway will result in a knockdown of two genes, PDGFR and ALK. Another connection is the combination of SiPDGFR beta and Crizotinib will result in a decrease in fold expression of both PDGFR and IGFR.

Research Mentors: Terry Shackleford, Ph.D.

OL Janae Hughes, Biaggini Scholar

Epigenetics in Forensic Science: A review

DNA methylation (DNAme) is an epigenetic mechanism that serves as a biomarker for forensic identification by reducing the number of potential suspects. It is tissue-specific, varies with age, responds to different environmental exposures, and is implicated in disease. Thus, offering unique profiles that aid in forensics. Previous studies have shown DNA methylation's efficacy in body fluid identification. With this, we suggest that DNAme can be measured in tissues undergoing decomposition. The aim of this project is to provide a review of the current literature of epigenetics to investigate if or how DNAme can be used to define tissues as various stages of decomposition.

Research Mentors: Jennifer Harr, Ph.D. and Veronica Contreras-Shannon, Ph.D.

OL Jocelyn Torres, Spring Research Fellowship

The contribution of diagnostic amino acids found in the ligand binding domain of teleost estrogen receptors to the differential binding of Genistein.

There are three estrogen receptors which facilitate transcriptional activity of genes when activated with estrogen. Breast cancer proliferation is facilitated in these ERs. The three estrogen receptors, ER α , ER β a, and ER β b, each have different binding affinities to Genistein. Genistein is an estrogenic compound found in soy that has a high binding affinity to ER β compared to ER α , this may be due to the presence of diagnostic amino acids in the LBD that differ in ER β subtype. In our lab students have tested many of these amino acid changes using mutant receptors, this study is an attempt to compile data and form a conclusion about the role of these amino acids in Genistein (GEN) binding to the ERs. This will also allow us to see GENs role in the proliferation of breast cancer tissue and elucidate ER ligand interactions in general.

Research Mentor: Mary Beth Hawkins, Ph.D.

34 Breanna Sellers

Nina Arteaga

Inhibition of SOX18 inhibits cell migration in Rhabdomyosarcoma and Ewing Sarcoma

Childhood soft tissue sarcoma, including Ewing's Sarcoma (ES) and Rhabdomyosarcoma (RMS), is a rare subtype of cancer. About 80% of childhood soft tissue sarcoma cases have been cured with medical breakthroughs in therapies. There are some patients with the metastatic disease that have limited options to second-line therapies. To best help the patients within this category, it's necessary to understand the progression of the disease to help identify new targets for future therapy development. Within these experiments, a total of three cell lines, EW8, ES8, and RH41, from ES and RMS, are being investigated to determine their connection to the transcription factor called SRY-Box Transcription Factor 18, or SOX18. Previous studies have shown different connections between SOX18 expression and the increase of activity of various cellular components. Within the following experiments, we aimed to determine the role SOX18 plays in pediatric sarcoma progression. By using siRNA knockdown techniques, the effect of SOX18 on cell viability, cell migration, and cell invasion were studied. The results illustrated that the SOX18 variation of siRNA used to achieve the knockdown of SOX18 within the cell lines used in these experiments was successful in the knock down of the SOX18 transcription factor, which is known to be expressed naturally within these cell lines using Quantitative Real Time PCR. Currently, the team is focusing on further trials of an invasion assay to determine if the knockdown of SOX18 inhibits tumor metastasis.

Research Mentor: Terry Shackleford, Ph.D.

35 Michael Trimble, Spring Research Fellowship

Metal-Organic-Frameworks (MOFs)

For many years, there had been many definitions for Metal-Organic Frameworks, more commonly known as MOFs. Since these multiple definitions were used, the question of what a MOF was became inconsistent. The more accurate representation of a MOF used in my research is that MOFs are a class of CP's comprising organic linkers wherein metalligand interaction/bonding leads to 2D or 3D crystalline network structures. These structures have areas called porous which originally contained solvent to keep its structure and are crystalline. However, the main question which determines if a MOF is produced is will the structure still stand once the solvent is removed? A resulting structure produces a MOF, and a resulting collapsing structure is considered a failure.

Research Mentor: Pius Adelani, Ph.D.

OL Valeria Acosta, Spring Research Fellowship 2021

Synthesis and characterization of a chemosensor for trivalent metal ions.

The chemosensor 1,4-bis(4-diethylaminobenzyl)-2,3-diaza-1,3-butadiene was synthesized from 4-diethylamino benzaldehyde and hydrazine. The yellow solid was characterized using NMR and FTIR spectroscopy. The absorbance and fluorescence of the chemosensor changed upon addition of the trivalent metal ions Fe3+, Cr3+, and Al3+.

Research Mentor: Susan Oxley, Ph.D.

OL Mariah Ramos, MARC*USTAR Andrea Aldaz Dianna Donnel

Drug optimization using hydrogen-deuterium exchanges

In a biopharmaceutical perspective, deuteration of a drug has a significant effect on its stability in metabolism due to the cleavage of C-H bond. Selective deuteration allows the retention of biochemical efficacy and selectivity of physiologically active compounds, as well as the modification of the metabolic outcome to remarkably maximize their potency. Xylene is a common motif found in many drugs, or drug-like compounds. The only synthesis of Xylene-D6 was previously found by Kwa, where dibromo benzene was treated with butyl lithium followed by quenching with deuterated methyl iodide; however, the yield was low and required undesirable conditions. We thus proposed that, under the mild condition of Palladium-on-carbon (Pd/C), D2O, and deuterium gas, the X-D6 can potentially be obtained through hydrogen- deuterium exchange (HDX) reactions. To evaluate the metabolism of drug candidates, we developed a metabolism assay using human liver microsomes at varying conditions. We also propose two new methods to analyze the successful synthesis of varying drug candidates under microwave conditions. We explored high-performance liquid chromatography and liquid chromatography- mass spectrometry as two efficient and reliable methods to analyze the metabolites obtained through metabolism. Finally, the deuteration of common antidepressant, Rolipram, was investigated under the same synthesis parameters. The site of deuteration was observed using Nuclear Magnetic Resonance. Overall, it was seen that deuteration had decreased the number of metabolites seen through HPLC.

Research Mentor: Xinghai Chen, Ph.D.

36 Victoria Rodriguez

Chef Jarelly Website

Due to the circumstances we live in today, it is vital that we not forget but contribute as well to our local businesses. Local businesses have been highly affected due to COVID-19. Small and local business provide opportunities to entrepreneurs and allow the community to be key contributors to important decisions. My goal is to help a current culinary school student grow her business. As of now she currently attends school and hold her own small cooking business via Instagram. The interactive Chef Jarelly website helps the chef, manage and facilitate her upcoming business. As a graduating culinary Chef Jarelly must be able to promote her business as well as attract new customers. The goal is to be eye-catching, concise and simple to be able to reach all age groups. The website will intend to inform the users background information of the chef as well as her recipes and dishes. In order to grow her business, the website will also include the ability to schedule a 1 on 1 meeting with the chef to discuss prices and tips. The website is not going to only focus on the tips and tricks provided by the chef but also have contribution from other users.

Research Mentor: Carol Redfield, Ph.D.

37 Megan Barnett

God's Treasures an Educational Game

As of now there is not an interactive program or game that focusses on enhancing what students learn before making their first communion. Many catechism classes today use worksheets and blackboards to teach students, however in today's times the options that are available have expanded with the use of technology. Young children learn in a variety of ways and online programs do exist that could be a solution, yet they do not follow the layout of the curriculum that is used for our archdiocese. Specifically, during this time when many classes have gone online it is unreasonable to expect families to teach their child everything on their own. God's Treasures was developed using the Unity game engine with the use of the language C# as this is the designated language for the program. The code editor used to write the code was visual studios. The end product is able to run on a desktop or Windows computer which is web enabled. A link will need to be provided to access the game online through a web browser. God's Treasures is a game designed for students in first through third grade to learn the importance of making their first communion. The interactive program includes ten levels in which the user can progressively unlock. Each level relates to a different lesson in the curriculum. The game contains numerous images to illustrate topics and concepts discussed in the lessons. These subjects encompass caring for others, giving thanks to God, and many more!

OL Adam Al-Rafati

Primal

Primal is a 3D survival video game developed using the Unity game engine software in C#. 3D assets are acquired from Blenderkit. The game runs on Windows 10 operating system. One of the issues of modern-day survival games is people simply do not have time to endure the grind of acquiring weapons and resources necessary to be able to challenge enemies. Looting and crafting for resources can be tiresome for many gamers and it can take a significant amount of time to finally make progress. Although some may enjoy the grinding aspect of survival games, others find it to be exhausting and overwhelming. Primal caters to individuals who favor the playstyle described. Primal features a variety of maps to choose from with a total of 10 unique areas that can be explored. Maps range from a medieval castle, a desert, an abandoned town, and much more. Modes of transportation are a prominent feature in this game. The player can ride their horse or drive automobiles to get to their desired location. The player needs to search the map for jerrycans to fuel up the vehicles before driving. Along the maps, the user may encounter threats such as zombies while at the same time it's important to keep a close eye on their hydration and health meter to avoid fainting. Fortunately, they are equipped with a shotgun to challenge them. Making survival games more accessible to newer gamers will hopefully attract newer gamers to the survival genre.

Research Mentor: Carol Redfield, Ph.D.

OL Maggie Amador Joel Trejo Miguel Rodriguez John Hannan Carlos Martin

The Rattler News Android Application

The Rattler is a student-run news publication of the St. Mary's University campus. This news publication is made by students for everyone on campus covering stories regarding events taking place in the community, sports, changes within the university, and much more. The pandemic has opened up the need for easier ways to connect to on-campus news, thus with a mobile application, it creates central domain of useability and access for each user to view and connect with The Rattler regardless if they are a current or past student, faculty, or staff member. The main and major functionalities that we plan to include are a search bar, suggestion form for users to enter their input or story ideas, categories viewable in a tab view format, the option to save articles, an advertisement submission form, and a coronavirus case counter on the home page. This app will be developed in XML and Java.

XML will be the language for our visual screens and Java will be the back end of our functions for the app. We will be developing the application using IntelliJ, a software that allows us to develop android applications. Currently, The Rattler News App will be built to run on Android OS because it best suits the skill set of the team. The goal of this app is to help The Rattler reach a wider audience and what better way to accomplish this than by creating a student-made app for a student-run publication.

Research Mentor: Carol Redfield, Ph.D.

OL Giovanni Doria

Ace of Spades (AOS)

Ace of Spades (AOS) is a game created with the intention to allow everyone to play a collection of card games. Card games include Blackjack, Crazy Eights, War, and more, providing both variety and simplicity. The game features many menu screens, each with their own purpose and functionalities. The main menu stores all options available to the user upon starting, Start Game, Options, Credits and Exit. Starting a game allows the user to select from a list of card games. Options allows for volume configuration and information about controls. Credits provide a scrolling list of those involved in the creation of the game and Exit simply ends the game. AOS was created using PyCharm, an integrated development environment that runs the language Python. The game runs on the PC platform and is built specifically for Windows 7 and greater. It is recommended that one has at least an Intel i5 core to ensure that the game runs as efficiently and effectively as possible.

Research Mentor: Carol Redfield, Ph.D.

OL Justin Garcia

TCG Cipher

TCG (Trading Card Game) Cipher is a website that seeks to assist both players and collectors of the Pokémon TCG. Developed using Atom text editor, XAMPP for server hosting and making use of HTML, PHP, and JavaScript programming languages. Built with accessibility in mind the website can be ran on both Windows 10 and Mac OS. TCG Cipher allows users to create an account to access the full suite of functionalities within the site. When users successfully create an account and log in to the website, they can choose from a list of different pages. In the Sets page, users can view the full list of main line expansions to the Pokémon TCG, select one and then view the complete set list of cards. From there, users can select a card and add it to their wish list or collection. In the Cards page, users can search a data base of Pokémon cards to find a specific card or cards and add them to their wish list or collection, while the Collection page allows the user to view every card within their collection. Users can also navigate to the trade page and

connect with users that have a card you want for trade. Finally, users of the website can use the What's New Page and About pages to learn about new rule changes, additions to the Pokémon TCG as a whole and read about what inspired the creation of the website.

Research Mentor: Carol Redfield, Ph.D.

OL Pragyan K C

Mujeeb Asabi Adelekan Nixon Pastor Guzmam Narayana Reddy Guduru Amelia Tristan Jared Zordilla

Rattler XChange

In St. Mary's University, students often have items they want to sell and exchange with other students. However, St. Mary's community does not have a platform that allows for such activities. There are instances where students have to post on Instagram, Facebook, Snapchat, or message an individual to sell or receive details of an item. To provide a safe, secure, and exclusive platform for the St. Mary's community, Rattler XChange was designed. Rattler XChange is an exclusive consumer-to-consumer marketplace for current St. Mary's students, professors, and faculty. The aim of Rattler XChange is to make the buying, selling, and exchanging of items safer and more accessible to the St. Mary's community. Rattler XChange is tailored for the St. Mary's community, so its user interface is easy to navigate and understand for current students and employees. Users can only sign up with an active St. Mary's email and will be able to view, sell, and buy products across campus to other verified users (verified via the active St. Mary's emails). If a user wants to propose a trade for a listed item, the user will have the option to connect with the seller via email. Rattler XChange is a customer to customer marketplace accessible from any device with an internet browser where products and users are up to date and communication between users is made easy through email.

Research Mentor: Carol Redfield, Ph.D.

OL Breanne Ludovice

Climate Clean Up

Climate Clean Up is a mobile game meant to teach and educate children and adults alike regarding the topic of climate restoration. Many people are familiar with the term, "climate change", but are they also aware of, "climate restoration"? Climate restoration is the goal to restore the Earth to healthier levels of carbon dioxide in the atmosphere. Currently, we are at around 400 ppm of CO2, however, the aim is to get back to at least 300 ppm. The player will learn about the effects of climate change on humans and living things, the

solutions to combating it, and how one can help in spreading awareness in the form of an educational game. This game was developed on Unity and Visual Studio using C# as the programming language. Climate Clean Up runs on Android devices.

Research Mentor: Carol Redfield, Ph.D.

OL Alex Montes

Nova

Nova is a 2D-Platformer for Android mobile devices that was inspired by older games like the Mega Man X series and Contra. The mobile gaming market has a variety of games with a growing number of 2D-platformers, but there are few that deliver a true classic 2Dplatforming experience. Nova's primary focus is to provide that experience by providing the player with basic functionalities, such as running, jumping, and shooting, but let them upgrade their character to unlock new abilities for specific situations or general purposes in multiple levels or boss fights. In addition, unique enemies, hidden rooms, rewards, and story are provided to keep the player engaged. Nova was developed using Godot, a game engine that provides developers with a built-in IDE and language. The language provided by Godot, GDScript, is a high-level, dynamically typed programming language that uses syntax similar to Python. The hardware used to develop/test was a Windows 10 laptop and Android phone.

Research Mentor: Carol Redfield, Ph.D.

OL Richard Ogin

Call Blocker

Everyday across the US, people are harassed by robot dialers calling their cell phones. It occurs to such an extent that they wait for voicemail messages to discern whether the interaction is worth the effort and potential frustration. People have sought reprieve by installing one of the several dozen call blockers from the Google Play Store. However, users are wary to allow access to their phone contacts and call history, yet to make use of these applications, users must grant permission to unverified code written by unknown developers to access data which is highly sensitive in nature. Users can now receive this functionality free from ads and potential data siphoning.

Call Blocker is a call blocker for the Android platform with multiple options to control its functionality in accordance with the user's preferences. It interacts with Android's Telephony API and allows the user to block incoming calls before the device begins its ring action. Its logging of incoming calls allows the user to review and act upon each phone number to include whitelisting, blacklisting, and creating a contact from it. All user data is kept on the user's phone, and no third-party systems are utilized.

Development occurred on a Windows 10 machine utilizing the Android Studio IDE which includes a code editor, compiler, and a host of Android emulators. The project is written in Java, and it runs on Android 10 or greater.

Research Mentor: Carol Redfield, Ph.D.

OL Miguel Rodriguez

Vehicle Doctor

Car trouble at the wrong time and wrong place is a nightmare that would be best never experienced. Years of learning about vehicles the hard way have allowed for a unique position full of experiences of a lifetime. These experiences include spontaneous engine combustion in late-night rural Texas, unexplained power loss on multiple occasions resulting in miles of pushing a very heavy vehicle, and continuous anxiety leading up to the next issue. This application is aimed to reduce panic and lack of knowledge in situations that are less than ideal by allowing the unsuspecting victims of car trouble to quickly diagnose and troubleshoot their vehicle at the touch of a couple of buttons by using the application Vehicle Doctor. Vehicle Doctor is aimed at being a comprehensive vehicle diagnostic application for Android devices and possibly IOS devices in the future. The applications will solve the problem by building upon the vast knowledge/data of seasoned car mechanics and narrowing this knowledge down to possible diagnoses by comparing user input to said data. Users will be able to use this application to simplify the unfortunate circumstance of car trouble by answering many simple questions until a solution is found. The application will then present information on the possible issue, urgency level, and further information provided in the form of links. Vehicle Doctor is developed in Android Studio using Coding Languages XML and Java on a Windows 10 Dell Alienware laptop.

Research Mentor: Carol Redfield, Ph.D.

OL Erik Shannon

"Don't Waste" - food waste management website

In a typical household, the families usually buy more food than they typically can consume. Sometimes, a shortage happens within food drives and donation centers. This problem turns into a worldwide issue. Global hunger is a problem we still continuously face each day. Food waste management is crucial since it can improve our environmental and economic sustainability. Food waste or food loss is food that is not eaten. The main causes of food waste are production, processing, consumption, and retail. Food waste plays a major factor in climate change and various environmental issues. Smart shopping is one of the most promoted ways to help eliminate food waste. This way is not usually as effective as most think. Household members still typically end up buying more than what their household needs or will consume so they end up wasting food. This informational website will allow users to locate nearby food donation centers and food pantries, sign up to become a consistent donator, and receive newsletters and requested foods from donation centers.

Research Mentor: Carol Redfield, Ph.D.

OL Jessica Sigler

Pinnacle Martial Arts Application

Pinnacle Martial Arts is a small privately owned business located in San Antonio, Texas. The purpose of creating the client this application is to help the client become more accessible for members by promoting current class schedules, upcoming events, and displaying merchandise. This application is expected to give an edge to the client's business by becoming more competitive with other martial arts gyms in the local area. The app begins with a user Id and password login screen, the application then displays a personalized main menu screen that contains the users name, current belt color, and month/year of membership. The user can select buttons to navigate pages to view merchandise, add items to a shopping cart, view shopping cart, checkout shopping cart, view class schedules, view upcoming tournaments, and check in to classes. The development tools utilized Microsoft Power Apps. Share Point lists are used to manage the inventory, class schedules, and each client's unique login ID. Microsoft Power Apps supports browsers with latest version of Microsoft Edge or Google Chrome, Apple iOS: Version 10 or higher, and Android: Version 7 or higher devices.

Research Mentor: Carol Redfield, Ph.D.

OL Samman Tyata

Udhyam - POS system

Point of sales systems, more commonly referred to as $\hat{a} \in POS'$, have changed the way that the hospitality industry does business with their customers. In addition to providing better features, and more streamlined services, POS systems also plays a major role in maximizing sales and automation by adding diversity and various other features for efficient operation. Numbers of POS systems have been proposed, but none of them are generally developed and designed for small scale businesses; moreover, a lot of them are usually expensive to set up and requires a large investment. Udhyam basically takes a lot of planning and researching on the small-scale businesses of Nepal and proposes a free application that requires little to no investment, and provides various features like inventory management, automation, and data management to streamline both the front end and the back end of the business.

Research Mentor: Carol Redfield, Ph.D.

OL Amanda Villarreal Alex Montes Natalie Rankin Darren Griffin Joe Flores Dat Trinh

STMU Campus Navigator

Navigating around college campuses has the potential for confusion, causing university students to end up lost or even late for classes, meetings, and other events. Even using Google Maps can prove unhelpful as it doesn't provide specific campus locations. Our St. Mary's Campus Navigator aims to solve this problem by helping the St. Mary's community easily navigate campus using our unique GPS based android app focused strictly on the St. Mary's University campus. The STMU Campus Navigator functions to display the St. Mary's University campus as a map screen, let the user search for campus locations through the Search Bar or Category Scroll Bar, display a selected campus location on the map screen, display a route to a selected location from the user's current location, start directions to said location, offer pictures of locations for assistance, call a campus location, and offer immediate directions and phone number to University Police Department. Our app is developed using the tools Android Studio, Android Virtual Device Emulator, Google Maps API, Directions API, GitHub online repository, GitHub Desktop, and GitBash, along with the programming languages Java, and Extensible Markup Language (XML). STMU Campus Navigator runs on an Android Samsung Galaxy S8 at minimum running at least Android 4.1 Jelly Bean OS.

Research Mentor: Carol Redfield, Ph.D.

38 Maria Isabel Vallejo Ciro Manuel Jose Carvajal Loaiza

Probabilistic Structural Fatigue and Risk Analysis on the PIPER -PA-28 Fleet, A Case Study

This work presents a risk-based fatigue analysis on the PIPER PA-28 fleet. The analysis focuses on the Fatigue Critical Location at the wing root with known previous failures. This study uses a probabilistic method applying the methodology shown in the Advisory Circular AC 23-13A issued by the Federal Aviation Administration (FAA). The analysis starts by performing a baseline fleet analysis and optimizing it based on field failure data found on the National Transportation Safety Board (NTBS). With an optimized model, the fleet hours to failure and the fleet life distribution were predicted. The initial risk analysis showed that the fleet has an unsafe condition. A more detailed risk analysis was done on a fleet of 46 airplanes with known flight hours from a survey performed on-line using data from PA-28 airplanes available for sale and a risk mitigation alternative was proposed. This work also proposed a risk management approach by installing a doubler in the wing spars to mitigate the risk.

Research Mentor: Juan D. Ocampo De Los Rios, Ph.D.

39 Joshua Webb

Design of a Mission Control Software for Controlling a Drone Swarm - Focus Group Research

Human-drone interaction research focuses on developing new control modalities for drones, such as gesture, speech, and multimodal interactions. One approach that has been previously explored on ground robots, but not yet with drones, is the use of a drag-anddrop user interface. Therefore, this study presents a new method of interacting with drones, allowing users to control a single or a swarm of drones in indoor environments by dragging and dropping icons such as drones or flight patterns to the desired location. The hypothesis is that this approach will enhance the usability of drone control systems by allowing both inexperienced and experienced users to quickly and easily program flights. This study presents the user interface design, which is based on data collected during an user study with 9 participants. For this user study, a focus group research methodology was chosen to collect insights, elicit requirements, and design ideas from 9 participants. This work presents the design for the control interface software, and how the system controls the drones. At the current stage, the application interfaces with the Ryze Tello drones, which were chosen based on their low-cost, small-size, and safety features. This work also presents future research directions, including a follow-up design, and a usability user study to evaluate the application.

Research Mentor: Dante Tezza, Ph.D.

OL Kenneth Gilley

Nuclear Power Plant Model

Nuclear power plants create nearly 55% of America's carbon-free energy, and of all the current sources of zero-carbon energy, nuclear power is the only one that has been demonstrated to be able meet the needs of a modern economy. The purpose of this project was to design and build a small-scale, realistic model of a nuclear reactor using LEGO toy bricks and to mathematically model and improve the efficiency and power output of the plant. This model replicates all of the necessary components of a pressurized water reactor (PWR), the most common type of nuclear energy facility. A primary coolant loop transfers heat from the reactor core to a heat exchanger/steam generator. The steam produced in this generator flows outside the radioactive containment area and through a turbine, eventually passing through a condenser and returning to the steam generator. If scaled up and slightly modified, this would be a good model for a nuclear energy generation facility on a large seagoing vessel or for a small town.

Research Mentor: Nazia Afrin, Ph.D.

OL Darian Jennings, MARC U*STAR

Algorithmic Development for Line Detection utilizing MATLAB

The most cost-effective and cost-efficient way of diagnosing bone fracture is through xray imaging. Due to the quality of the x-ray images often hair-line fractures are missed, which in a long-term it can cause severe arthritis in the bone. This is especially common in hairline fractures in carpal bones in hand, which can occur on a simple fall while a person tries to catch themself using his/her hand. There are different edge detection algorithms that can be used for bone fractures in the bone, however, none of these generic algorithms can detect all hairline fractures in the bone. The purpose of this study is to explore different techniques to enhance the edge detection algorithms in order to make them more effective in the detection of hairline fractures, especially in carpal bones.

Research Mentors: Bahman Reziae, Ph.D. and Veronica Contreras-Shannon, Ph.D.

OL Jonathan Lopez

Surrogate Based Kriging optimization For Laser Induced Thermal Damage

As radioactive material decays, or breaks down, the energy released into the environment has two ways of harming a body that is exposed to it, Higley said. It can directly kill cells,

or it can cause mutations to DNA. If those mutations are not repaired, the cell may turn cancerous. Exposure to low levels of radiation does not cause immediate health effects but can cause a small increase in the risk. The probability of injury, disease or death from exposure to a hazard. Radiation risk may refer to all excess cancers caused by radiation exposure (incidence risk) or only excess fatal cancers (mortality risk). Risk may be expressed as a percent, a fraction, or a decimal value. For example, a 1% excess risk of cancer incidence is the same as a 1 in a hundred (1/100) risk or a risk of 0.01. of cancer over a lifetime. There are studies that keep track of groups of people who have been exposed to radiation, including atomic bomb survivors and radiation industry workers. These studies show that radiation exposure increases the chance of getting cancer, and the risk increases as the dose increases: the higher the dose, the greater the risk. Conversely, cancer risk from radiation exposure declines as the dose falls: the lower the dose, the lower the risk.

Research Mentors: Nazia Afrin, Ph.D. and Juan D. Ocampo De Los Rios, Ph.D.

OL Rhianna Lopez, MARC U*STAR and Spring Research Fellowship

Assistive Technology for The Visually Impaired

There are approximately 12 million patients in the United States who suffer from vision impairments and struggle daily through completing everyday activities. For instance, Stargardt is a non-age-related form of macular degeneration disease that causes central vision loss. According to the National Eye Institute, one in eight-ten thousand people suffer from Stargardt. With new assistive technologies becoming popular to patients and improving their quality of life, there are still downfalls in these technologies. To provide a positive user experience, these technologies must be safe, easy-to-use, and comfortable. Additionally, a low-cost is required to increase its accessibility, as users may experience financial obstacles in acquiring assistive technologies. This study presents a comprehensive review of assistive technologies for visually impaired users. More specifically, it discusses how they can improve the lives of patients diagnosed with Stargardt and these technologies' limitations. Users diagnosed with Stargardt usually maintain their peripheral vision, however, they suffer from high-sensitivity to light. Users have expressed that if the environment light and color conditions are ideal, their vision is improved substantially. Therefore, this work proposes a new assistive technology that processes the image from a camera to match the ideal image characteristics for a user diagnosed with Stargardt before displaying it in a head-mounted display. Lastly, this work discusses future research directions in the field and a usability study to evaluate the proposed solution.

Research Mentor: Dante Tezza, Ph.D.

40 Midori Flores, MARC U*STAR

The Toxicity of Polystyrene Microplastics on C. elegans

The effects of microplastics on human health is an up-and-coming area of research. Microplastics have been located widespread in the body, including in blood vessels, and have recently been found to pass from a mother's womb into a developing fetus. While exact consequences remain unknown, it is speculated that the fine particles cause an array of issues, such as reproductive health issues and obesity, among others. It is imperative that we continue to study the impacts of microplastics in relation to public health. In exposing C. elegans to microplastics, we may develop a better understanding on health effects on humans. First, an ingestion assay will be performed to examine the ingestion of microplastics (1.00, 1.50, and 3.00 microns) by C. elegans nematodes. Locomotion and thrashing/bending assays will then be performed, followed by toxicological experimentation to analyze survival and reproduction rates, as well as brood size. Finally, C. elegans nematodes with a green fluorescence protein tag on cytoskeleton protein elements will be exposed to the microplastics, and microscopic imaging will be performed for cytoskeleton and sarcomere analysis. Sarcomere cell lengths will be recorded using ImageJ software, and statistical tests will be performed in SPSS to see if cell lengths are similar to those from a C. elegans muscular dystrophy model. If there should be any similarity, we will have jurisdiction to investigate the relationship between microplastics and a muscular dystrophy phenotype further.

Research Mentor: Jennifer C. Harr, Ph.D.

41 Ricardo Zamora, MARC U*STAR

Capturing Solar Energy with Quantum Dots

Luminescent Solar Concentrators are being studied for use in windows as an alternative to current solar panel technology. Current LSC technology has been plagued with inefficiency and practicality. Quantum dots have been used in LSCs, where most examples use one type of quantum dot absorbing solar energy and emitting energy at a different wavelength for energy collection. To increase optical efficiency of an LEC, we are implementing a coupled-quantum dot system, where the two quantum dots Forster Resonance Energy Transfer (FRET). We hope that the inclusion of a coupled-quantum dot system using FRET will increase energy transfer to solar collecting devices within an LSC, therefore increasing optical efficiency. Furthermore, an increase in optical efficiency would make LSCs more efficient and practical for widespread use.

Research Mentor: Richard L. Lombardini, Ph.D.

OL Hailey Dienglewicz, SALE Scholar

Distribution and Adaptability of the Trees on St. Mary's Campus

There are many benefits to having trees in a community, from their shade providing cooler temperatures within an urban heat island, carbon uptake, and even aesthetics. These examples show how trees aid the environment and make the areas they're within more habitable. In this research project, we conducted a survey for the trees on St. Mary's campus. The purpose of this study was to analyze the adaptability and distribution of trees on campus and to compare this survey to the one conducted in 1999. In San Antonio, there is the Tree Preservation Ordinance as well as the SATX Clean Air Action Plan. The Tree Ordinance handles the maintenance, preservation, and addition of the existing tree population, and the SATX Clean Air Action Plan works to enact policies and programs that reduce air pollution with regulatory actions. In this project, our survey includes tree species, the circumference of the tree, the location of the tree, and if the trees are native or introduced species when looking at their adaptability. Once the data was collected, it was entered into Excel and GIS to calculate the findings. From the data, the majority of tree species on campus included Live Oak (Quercus virginiana), Crepe Myrtle (Lagerstromia), and Pecan (Carya illinoinensis), with the largest circumferences being 240 inches (Pecan -Carya illinoinensis), 216 inches (Juniper - Juniperus) and 180 inches (Juniper - Juniperus). When looking at the distribution of pecan trees on campus, the densest section is up towards the northeast corner.

Research Mentor: David Turner, Ph.D.

OL David Feagins, MARC U*STAR Steven Lentz

The Acidification of Coral Reefs: Controls on the Carbonate Chemistry of a Coral Reef Lagoon

Coral reefs are built from the carbonate skeletons of calcifying organisms. Ocean acidification impacts coral reefs by reducing the availability of carbonate ions needed for calcification. 21st-century model projections of coral reef futures imply that reefs could start net eroding by mid-century. However, physical, chemical and biological processes including photosynthesis and respiration, calcification and dissolution exert strong controls over reef water chemistry that may be modulated or exacerbated by seawater residence time, evaporation and precipitation. Analysis of discrete water samples collected on Kanton Island during 2012, 2015 and 2018 provide important clues about the influence of benthic metabolism on reef-water chemistry and the potential influence of El Nino. Samples were taken throughout the day at 5 m depth along a transect that started in the open ocean, through the channel, and across the 17 km long lagoon. In all three years, salinity-normalized total alkalinity (TA) and dissolved inorganic carbon (DIC) of ocean water entering the lagoon decreased, by as much as 12.57% and 14.86%. During 2012 and 2018, the decrease in TA is approximately the same as the decrease in DIC indicating that the

relationship between photosynthesis, respiration, calcification and dissolution remains constant throughout the lagoon and that net production is approximately equal to net calcification. DIC in 2015 was drawn down less compared to DIC in 2012 and 2018. In conclusion, the Kanton lagoon maintains a strong chemical gradient in respect to TA and DIC, which shows that acidification in coral reefs is very different from open ocean acidification.

Research Mentors: Anne Cohen, Ph.D. and Weifu Guo, Ph.D.

OL Zoe Vanover, McNair Scholar

Observations of Helium Pickup Ions in the 2019 Focusing Cone Encounter

Interstellar pickup ions enter the solar system in a neutral charge state. Neutral atoms with trajectories near the Sun come under its gravitational influence and are focused downwind of the Sun to a distance, which depends on their mass. Interactions within the solar radiation environment ionize the interstellar neutrals, which are subsequently picked up by the interplanetary magnetic field (IMF). Since we're approaching a solar minimum, we would expect to see the radiation environment decrease, which would result in the increase of hydrogen protons in the cone due to the decrease in the production of Lyman alpha particles. While we do see an increase in hydrogen particles, we cannot determine what is coronal hydrogen or pickup hydrogen and it has yet to be understood how to distinguish between the two. The solar wind and the ion population have very similar compositions; however, we are able to differentiate the two by the wider spread of velocities of pickup ions with an upper limit of 2x the solar wind. The pitch angle, also known as the preferred orientation of the plane of the PUIs, can be calculated by taking the angle between the magnetic field and the direction of the flow of particles. The magnetic field is subject to fluctuations as well as the production of the particles themselves causes turbulence. Both these sources of turbulence cause pitch angle scattering which is being investigated for more accurate data acquisitions.

Research Mentor: Roman Gomez, Ph.D.

2020 Summer Undergraduate Research Fellows

42 Regina de la Parra

Studying the effect of course modifications on student learning

This project seeks to understand if there's any benefit to modifying courses from noninteractive engagement to interactive engagement. The first ones usually limited to traditional lectures and teacher-centric lectures, while the latter can contain a myriad of different activities to foster learning. For example, interactive courses can contain not only traditional lectures, but also group discussion, hands on activities, and other applicable constructs. For the past six years, data has been collected from every introductory physics class taught by the Physics Department with different instructors. The data used covered examinations conducted on students in both Physics 1401 and Physics 1404 at St. Mary's University. By comparing and analyzing this data, the effect of different changes to the way the course is taught to the gain in knowledge based on pre- and post-exam results. This will increase in the current knowledge about teaching styles, more specifically towards St. Mary's students and other institutions.

Research Mentor: Richard Cardenas, Ph.D.

OL Reagan Gately

An Investigation of Scalar Field Dynamics in the Early Universe

One of the major ideas in the current theory that describes the universe is that all particles are simply excitations of an underlying field that permeates all of time and space. One very interesting type of field is a scalar field, such as the famous Higgs field. Understanding how scalar fields evolve with time gives us a window into what was happening in the early universe. The goal of our research is to model the behavior of scalar fields using computational techniques. To accomplish this goal, we utilized the LatticeEasy software package along with a collection of custom-made python tools for data analysis.

Research Mentor: Patrick Greene, Ph.D.

OL Gabriella Gonzalez

Be Gentle: An Analysis of the Role of Self-talk

Language matters. It matters not just in interpersonal communication, but in intrapersonal communication as well. Currently, many youths and young adults are struggling with an "explosion of mental health problems" as reported in universities across the country (Rostain). Mental health research indicates the importance of maintaining perspective over what we can control. One controllable aspect is the language we actively use in our internal dialogues: self-talk. My research focuses on the use of self-talk as a coping mechanism for youth and young adults. This project continues my research initiated in the Fall 2019 course, the Language of Peace. My previous research, based on interviews with mental health professionals, focused on the relationship between self-talk and inner peace. As this research progressed, I began analyzing Instagram posts. Based on my previous findings, my revised research question is: How does the language used in images found on Instagram promote inner peace, and what are the preferences expressed regarding the posts that resonate the most with viewers? Using Critical Discourse Analysis and MAXQDA software, this research project explores the phenomena of self-talk, especially in relation to the usage of particular language structures.

Research Mentor: Mary Lynne Gasaway Hill, Ph.D.

OL Pragyan K C

Identifying and Classifying Third-Party Entities in Natural Language and Privacy Policies.

App developers often raise revenue by contracting with third party ad networks, which serve targeted ads to end-users. To this end, a free app may collect data about its users and share it with advertising companies for targeting purposes. Regulations such as General Data Protection Regulation (GDPR) require transparency with respect to the recipients (or categories of recipients) of user data. These regulations call for app developers to have privacy policies that disclose those third-party recipients of user data. Privacy policies provide users transparency into what data an app will access, collect, shared, and retain. Given the size of app marketplaces, verifying compliance with such regulations is a tedious task. This project aims to develop an automated approach to extract and categorize third party data recipients (i.e., entities) declared in privacy policies. We analyze 100 privacy policies associated with most downloaded apps in the Google Play Store. We crowdsource the collection and annotation of app privacy policies to establish the ground truth with respect to third party entities. From this, we train various models to extract third party entities automatically. Our best model achieves average F1 score of 66% when compared to crowdsourced annotations.

Research Mentor: Mitra Bokaei Hosseini, Ph.D.

OL Chika Onwuzurike

A non-invasive assessment of population characteristics of coyote populations in Galveston, TX

The red wolf (Canis rufus) was removed from most of its historic range by the late 1960s and has been an endangered species since 1967. Hybridization with coyote (Canis latrans) populations serves as a major threat to the persistence of the red wolf population in the wild. In 2018, 2 scientific studies reported that red wolf DNA was identified in coyotes in Texas and Louisiana. The purpose of the present study was to use non-invasive sampling techniques (camera traps and scat samples) on the canid population in Galveston, TX to assess coyote population size, sample location characteristics, and morphological measurements on the coyote population in the Galveston area.

Research Mentor: Melissa Karlin, Ph.D.

OL Carlos Rosales Moran

High-Capacity Data Hiding in Encrypted Images using MSB Prediction

Digital image security is an essential aspect in fields in which the confidentiality of images and information is crucial. As a result, encrypted image processing has become a significant source of attention in academia. The purpose of image encryption is to guarantee data privacy by randomizing the content of the original images. Data hiding in encrypted images (DHEI) is how we can embed data into an encrypted domain. For example, an image owner encrypts a picture with a secret key, and it is still possible to add additional data into the image without knowing the content or the secret key. After the image goes through different processes, we can extract the message, and the initial image is recovered in a decoding phase. During this research program, I built a graphical user interface using Java and JavaFX that allows users to upload a grayscale image, preprocess the image, encrypt it, embed a hidden message by changing the most significant bit (MSB) by a bit of the message, and reconstruct the image based on MSB prediction. Such an application will allow for further research in the field. For the future, I plan to implement an algorithm that enables users to upload RGB images to encrypt hidden messages by separating each channel and processing each channel differently. Such implementation will triple the embedding capacity of information within images.

Research Mentor: Wenbin Luo, Ph.D.

OL Ana Paula Saravia Lopez

Economic Impact Analysis of the Chinchero Airport in Cusco, Peru

The ambitious Peruvian project for a new international airport in its main touristic region, Cusco, is expected to offer its services to the public by the end of 2024. The long-delayed project looks forward to increase and improve the supply or transportation services for tourists and make their trip to Cusco more efficient. Ultimately, the goal of the new airport is to increase tourism in the region. Economic development, new services and businesses, urbanization, new job openings and reduced poverty levels will be some of the benefits of the Chinchero International Airport. Nevertheless, it has been a controversial project since the beginning, the reason why it has been delayed for more than two terms of office. The location of the airport, in the rural town of Chinchero, has raised questions about the true benefits of the airport and its environmental costs for the local communities. Three major concerns are: (1) the air and noise pollution caused by the new airport; (2) the cultural degradation; and (3) the impact on the Inca heritage and on the local economy. This report seeks to offer answers to these questions using both Cost-Benefit Analysis and the Environmental Kuznets Curve (EKC) hypothesis. Furthermore, this paper discusses the importance of cultural heritage and how to account for its value and examine the information asymmetry between government and rural citizens in Chinchero.

Research Mentor: Belinda Roman, Ph.D.

OL Victoria Valle

A Digital Edition of the Squatter and the Don by María Amparo Ruiz de Burton

My project uses digital humanities tools to create a digital edition of María Amparo Ruiz de Burton's The Squatter and the Don (1885), the first novel published in English by a Mexican-American woman. This project focuses specifically on recovering the female, Mexican-American voice in 19th-century literature. At the time of its publication, the novel did not garner much attention, but in the late 1990s, it was rediscovered and printed by Arte Público Press with an informative, critical analysis as an introduction by Beatrice Pita and Rosaura Sánchez. This digital edition pushes their recovery of Ruiz de Burton's novel further by recontextualizing the narrative with historical documents, legislature, definitions, and photographs for modern-day readers. The project, which lives on a WordPress website, uses principles of digital humanities to explore digital literary accessibility, intertextuality, and recovery.

Research Mentor: Benjamin Doty, Ph.D.

High School

43 Malachi Drew

John Jay Science and Engineering Academy

Oxygen Enrichment for 2-Stroke Gasoline Engines

Gasoline vehicles often use only a small portion of their engine's power when travelling at a constant speed, and a larger engine is less efficient when little power is required. Thus, it is beneficial to have a smaller engine, but with more power for acceleration. More power can be added to an engine by increasing the amount of oxygen available for combustion. This project investigates oxygen enrichment for 2-stroke gasoline engines to increase power. Four hypotheses were tested: H1& H2 stated that increasing oxygen content of the intake air from 21% to 25% & 25% to 30% would increase power. H₃ & H₄ stated that increasing oxygen content of the intake air from 21% to 25% & 25% to 30% would decrease exhaust gas temperature (EGT). To test the hypotheses, a system was built to allow control of the oxygen content and measurement of the power output and EGT. Twenty tests each were performed with 21%, 25%, and 30% oxygen content. Power output and EGT for each test were recorded and a series of t-tests were used to analyze the data. The first hypothesis was accepted, as the p-value was 0.024. The second hypothesis, however, was rejected, as the p-value was 0.06, which was above the 0.05 limit. The third and fourth hypotheses were accepted, with p-values of 6.45*10^-8 and 0.042 respectively. These results suggest that oxygen enrichment for 2-stroke gasoline engines is effective in increasing power, though further research is needed to determine the best use of such technology.

Research Mentor: Christopher Tijerina

44 Ryan Fletcherr

John Jay Science and Engineering Academy

Simulation of Pluto's Tholine Creation In Its Intermittent Atmosphere Due To Its Elliptical Orbit

Due to the New Horizons mission, a lot of questions have risen about Pluto. This project aimed to simulate the process of elements condensing back onto its surface as it revolves away from the Sun, with a focus on how it produces biological molecules. The hypothesis was that when liquid nitrogen is introduced, the water in the chamber will freeze onto the copper plate, reducing the pressure of the chamber. Background research was performed on Pluto and all other topics involved with this project to provide background knowledge. Following that, the full list of materials was obtained to perform the experiment. After that, several KF-50 flanges were removed and replaced with adapters for a pressure reader, vacuum pump, injection valve, and a copper plate along with their appropriate gaskets and clamps for the purposes of configuring the chamber for the project. After the hose of the

vacuum pump was attached to the adapter. A test run for pulling vacuum was then performed, and several leaks were identified and fixed. Following that, the experiment was conducted. The data from the experiment was then analyzed, and turned into tables and graphs. The hypothesis for this project was accepted. In each of the trials the chamber pressure dropped by at least 10 Torr after the liquid nitrogen was poured. This proves the water froze to the copper plate, as water has a very specific pressure, and that pressure was lost when it turned into ice.

Research Mentor: Ed Patrick

45 Kiera Ocampo

John Jay Science and Engineering Academy

Solar Panel Evaporative Cooling in the Splash Zone

A Solar Panel's power output correlates to how hot the panel is demonstrating that as temperature decreases, power increases. This project demonstrates that the evaporation of water can be used to effectively cool a solar panel with minimal amounts of water runoff. Solar noon is a period of time when the sun transmits the most photons to the panel if during the period the panel were to be cooled down using minimal amounts of water the power output would be maximized. To decrease the temperature efficiently, equal cooling coverage will be needed. A manifold system (an arrangement of spray bars with nozzles) was developed to create this equal coverage. In the development of the manifold system, straight nozzles were used for their fast response timing and ability to control water delivery. This allowed for water delivered to be minimal, and make evaporation occur throughout the test. The hypothesis that evaporation of water can be used to effectively cool a solar panel with minimal amounts of water runoff is partially supported. Minimal amounts of water were able to effectively cool the panel demonstrated by the power increase in the data being relatively close to the predicted power increase. But due to the fact that the majority of the effective temperature coefficient was off the panel's rated temperature coefficient, the panel wasn't evenly cooled. The manifold did have the success of being able to cool the panel letting the temperature drop, and having power increase, but not having equally cooling coverage as predicted.

Research Mentor: Joe Redfield

46 Vincent Tomasetti

John Jay Science and Engineering Academy

Analysis of an Effective Left Turn Based Corridor and its Modeled Implementation

Studies have shown that the corridor along SH-16 would be greatly improved by the implementation of innovative intersections. However, little was known about the effects that the impact could have on surrounding intersections and the independent turning movements for this corridor. The purpose of this study was to model the effects that a

Restricted Crossing U-Turn would have on surrounding intersections and their independent lane movements. Factors considered were the total delay per vehicle, emission, cost, and lane-delay. The hypothesis tested was that RCUTs would improve flow of traffic in high density areas, while maintaining the performance of surrounding intersections.

In this study, a corridor was selected on San Antonio's Northwest side along SH-16 between the intersections of Huebner Rd. and Mystic Parkway. The extended corridor along SH-16 was then modeled using Synchro 10. At the intersections of SH-16 and Eckhert Rd., and SH-16 and Mainland an RCUT was modeled to improve corridor flow. Another corridor was modeled with all conventional intersections. These two corridors were run in Simtraffic 10, yielding the delay and emission data. These data sets were then analyzed to test the hypothesis.

The hypothesis was supported by the data. The implementation of the RCUT at Mainland and Eckhert Rd. significantly improved the intersection delay. There were instances of both an increase and decrease in delays at certain intersections, causing minimal change to the average operation or delay of each intersection. This implementation had a neutral impact at surrounding intersections, however, corridor flow was improved.

Research Mentor: Courtney Corbell

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The Jose Cimadevilla Seminar Series

Friday, April 23, 2021

1:30-2:30 pm

Mariah Ramos, MARC U*STAR, Biochemistry major Amanda Garcia, MARC U*STAR, Biology major Isabelle Bergman, MARC U*STAR, Biochemistry major David Feagins, MARC U*STAR, Biophysics

Closing Reception

Friday, April 23, 2021 in Pecan Grove

4:00-6:00 pm Welcome remarks, President Mengler Opening Prayer, Father Richard Villa Reception and awards announcements: Internal Faculty Research Grants Summer Undergraduate Research Fellowships Faculty Research Mentoring Award 22nd Annual Symposium Awards





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