

# **Virtual Undergraduate Research Scholars Symposium**

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**Abstract Book**

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**Texas A&M University**



**LAUNCH**

**UNDERGRADUATE RESEARCH**

**Title: "And the Cat Looked": A Creative Thesis**

*Author: Meredith White*

*Primary URS Faculty Advisor: Dr. Lowell White*

**Abstract:**

This is a creative work that looks at the practice of ritualistic human sacrifice throughout different ages and cultures and how this custom affects the people of that society. While it is commonly known that ancient civilizations practiced forms of human sacrifice, it is not overtly shared what their reasons were and how they differed. With various interpretations of religion, these customs can affect the self-worth of a people whose lives hinge on an assigned fate that cannot be avoided in a Calvinistic way that stifles creative expression, individualism, and lives. The main character of my story, a boy named Brennan, is a chosen sacrifice to a deity, and the story will explore his upbringing, his relations to his peers and the world around him, and his mindset. While submitting to the rigid structures of society, Brennan does not escape his fate, but through study and research, the people of the future are able to find his journal and understand the situation of his very short life in relation to the power of knowledge and uncovering the truth.

**Title: "Lakeshore Complex" for the University of Wisconsin-Madison Dormitory to Surge Hospital Conversion**

*Author(s): Virgilio Duarte, Jonathan Latta*

*Primary URS Faculty Advisor: George J. Mann, AIA*

*Co-URS Faculty Advisor: Ronald L. Skaggs*

*Co-URS Faculty Advisor: Joseph G. Sprague*

**Abstract:**

Located in the Heart of the University of Wisconsin Madison lies our teams proposal for a Dorm tower complex. The projects conception began with the notion to create a complex that mediates between the main campus and the student lifestyle located on either end of the site. Formally, the project is a product of the idea of fragmentation and erosion in which the students are the catalyst for. By allowing for the separation of the complex into three parts, we were able to adapt the site to account for a community area that encompasses an open student lifestyle that was lacking within the campus beforehand. While we greatly considered all the necessary aspects of the project when functioning as a Dorm complex, we also had to consider the necessity of adapting the project to accommodate a surge environment in case of an overrun of patients in a pandemic. Research was conducted to ensure what would be the most efficient facility to adapt to a surge environment. We concluded the dorm complex would be efficient in this setting due to the accessibility to private rooms and bathrooms, study rooms, as well as large open spaces that can be converted into labs or storage areas. Our projects goal was to create an environment that sought to evoke a sense of community and life into the campus as well as an area that can be adaptable to be a surge facility.

**Title: Antisemitism, Secularism, and the Catholic Church in the European Union**

*Author(s): Makenzie Glavin, Madison Cowart*

*Primary URS Faculty Advisor: Alexander Pacek*

**Abstract:**

The evidence of a rising antisemitic problem in the European Union has become impossible to ignore. In wake of decreasing amounts of religiosity, the Catholic Church, even in "secular" countries, retains its tight fist in things such as cultural outlook and political influence. It is noticeable that the Catholic Church has effects lingering in politics, but combined with the upsurge of secularization in the European Union it stands to reason that antisemitism could result from this contradiction. This study aims to combine all of these factors to develop a well-rounded and holistic observance of the antisemitic phenomenon in the European Union, including secularism and the Catholic Church. The methodology required of this is research through historical, religious, and political lenses, considering only the countries that present themselves to have this issue. We break down our analysis into historical and current expressions of antisemitism and examine them through the context of secularism and the Catholic Church. We expect to find a strong correlation between antisemitism and countries that, while secular in political categorization, are historically influenced by the catholic church. In contrast, we expect to find that countries with no set catholic affiliations and or secularism, tend to not experience as many antisemitic incidences. Preliminary conclusions show that traditionally Catholic and

Christian nation-states hold antisemitism as a historical leftover, whether it be consciously in terms of public policy or subconsciously permeating cultural practices. These can manifest higher when there is a veil of “secularization”, and depending on the severity and type of secularization, can result in higher incidents of antisemitism.

**Title: 'An Illusory World': Cold War Convergence Between India and the United States in the Third World to Counter China's Rise**

*Author: Kedar Pandya*

*Primary URS Faculty Advisor: Jason Parker, Ph.D.*

**Abstract:**

Traditional readings of the relationship between the United States and India during the Cold War characterize it as up-and-down. Strategic blunders made by the United States, such as an alliance with Pakistan, alongside India's flexibly inflexible non-aligned foreign policy limited engagement across the board. However, convergence between the two countries was able to overcome significant strategic and policy differences on a number of key issues. The foremost of these issues was the rise of China, and in the late 50s, it occupied the top of both American and Indian strategy. Recent works, such as Tanvi Madan's *The Fateful Triangle: The United States, India, and China During the Cold War* have discussed the role China played as a motivating and limiting factor in relations between the US and India. However, coordination between the two countries in the Third World has been significantly overlooked. This article discusses the limitations and catalysis for US-India relations in the Third World Project between the Bandung Conference in 1955 and the Sino-Indian War in 1962. The author finds that, despite the traditionally negative attitude of the United States towards the institutions of the Third World, and the stringency with which India adhered to non-alignment, convergence and coordination between the two countries in the Third World was significant.

**Title: A Genetic Screen to Identify Viral Proteins Participating in the Lysis Inhibition System of Bacteriophage N4**

*Author(s): Adam Tomaszewski*

*Primary URS Faculty Advisor: Ryland Young, Ph.D.*

**Abstract:**

Bacteriophages, or phages, are viruses that infect bacterial cells. Once phage have infected cells, they hijack the host machinery to create more copies of themselves. The final stage of the infection cycle- known as lysis- is an event where the cell wall is then ruptured in a process known as lysis to release virions to the environment and begin the infection cycle anew. To achieve lysis, bacteriophages encode proteins that target the cell envelope and time its destruction. This study investigates the molecular mechanism of lysis in *E. coli* bacteriophage N4, which can delay lysis through a mechanic called lysis inhibition. In fact, an N4 infection begins lysis at 200 minutes whereas the well-studies phage lambda begins at 60 minutes. We hypothesized that N4 achieves lysis inhibition using viral proteins of unknown function by targeting lysis proteins with unidentified viral proteins. To investigate this, wild type N4 was subjected to a selection for spontaneous mutants that had lost the ability to delay lysis. The resulting lines were sequenced to detect mutations that stopped lysis inhibition correlated with earlier lysis timing. A growing panel of mutants was generated and genetic analysis is ongoing. Though not yet saturating, current results reveal that several different mutations result in loss of lysis inhibition. Mutations found within the lysis genes provides an avenue to understand the mechanistic basis for the timing of lysis while changes found outside the lysis genes have potential to reveal genes outside in other places that that control lysis inhibition. These results are informing our model in which N4 orchestrates lysis inhibition using multiple viral membrane proteins. This study is important because phage have the potential to be used in the treatment of bacterial infections in humans. By understanding lysis inhibition in N4, we can take one more step on the path to using bacteriophages to treat disease.

**Title: A Philosophical Perspective on Political Polarization**

*Author(s): Marina Galvan*

*Primary URS Faculty Advisor: Kenneth Easwaran, Ph.D.*

**Abstract:**

Polarization has become an increasingly concern for the United States, especially in recent years. Which philosophical political ideals can we use to understand the issue of polarization in democratic societies? In order to answer this question, this work analyzes philosophical texts such as Plato's *Statesman*, Aristotle's *Politics*, and Hannah Arendt's *Between Past and Future* to find ideals that are best suited to highlight the issues polarization brings on our political entities.

In the end, there are four philosophical ideals that are threatened if polarization continues to increase in democratic societies. The first threatened ideal is Arendt's emphasis on the importance of freedom of speech. Cass Sunstein argues that social media has enabled polarization that threatens free speech by encouraging people to refrain from it. Second, Arendt warns that the connection of truth and politics is fragile. Regina Rini argues that social media has weakened this already fragile link. In the third ideal Plato's ideal of the statesman is as someone who weaves people of different personalities together. Kevin Dorst argues that polarization on social media creates demonization, that makes this impossible. The final ideal is Aristotle's that states human flourishing is the sole purpose of political entities has been lost due to the loss of political empathy that Dorst describes.

Seeing how polarization and its effects have challenged these ideals on the political sphere does two things. One, it highlights the scope of how dangerous increasing polarization is to democratic societies. Secondly, understanding polarization can lead to better formulated ways to address this issue and restore the political entities ancient philosophers sought out for us.

**Title: A Priori Modeling of Thermal Runaway Consequences in Lithium-Ion Batteries**

*Author(s): Ritika Bhattacharjee, Christian Landry*

*Primary URS Faculty Advisor: Eric L. Petersen, Ph.D.*

*Co-URS Faculty Advisor: James C. Thomas, Ph.D.*

**Abstract:**

While there exist numerous experimental methods to predict the catastrophic failure of lithium ion batteries (LIB) and the associated hazards of thermal runaway (TR), these experimental methods can be time-intensive and costly. Furthermore, the available hazard information regarding toxic product formation of LIB TR is dependent on the specific types of LIB systems tested in the laboratory since battery chemistry is rarely disclosed by manufacturers. This work reviewed the experimental results of groups that modeled LIB TR and utilized experimental methods involving closed-vessel gas sampling, accelerating rate calorimetry, cone calorimetry, and Tewarson calorimeters. Those results were then used in the development of an a priori modeling tool which utilized chemical equilibrium analysis (CEA) to predict LIB TR combustion hazards. In the literature review, it was found that all experimental methods have shortcomings. Cone and Tewarson calorimeters possess flame set-ups that must be open to ambient air and its subsequent gases to be sufficiently vented, and as such lead to less control in the measurement of toxic gas production. However, both of these calorimeters are good at producing the same TR to be expected in LIB industrial failure situations. Experimental setups involving accelerated rate calorimetry (ARC) fail to model complete TR, as the heating of the battery is much more gradual than to be expected in an actual TR situation.

**Title: A study of bacterial produced endolysins on the peptidoglycan layer of Clostridium difficile**

*Author(s): William Meyers*

*Primary URS Faculty Advisor: Joseph Sorg, Ph. D*

**Abstract:**

*Clostridium difficile* sporulation is a vital part of the life cycle for this Gram-positive bacterium. During this process, the mother cell packages proteins into the developing endospore. However, the mechanisms by which many of these proteins are secreted into the spore context layer is unknown. Using an endolysin as a reporter protein to translationally fuse to potential sporulation secretion substrates would help determine if the secreted proteins is destined for the cortex layer or if it remains in the outer coat. This thesis takes a

bioinformatics approach to identify a suitable endolysin. By searching the primary literature and online databases, a variety of naturally produced endolysins derived from several *C. difficile* strains, similar bacteria species and phages were gathered into a list. From this list, these proteins were fed into Basic Local Alignment Tool (BLAST) to determine which of these were present in multiple organisms. Next, the potential cellular location of these candidate proteins was determined using the Psort algorithm. While the Psort was unable to determine where many of the putative reporter proteins were located and it did give results for some that could be of use. This new reporter protein would give new insight on the process of sporulation, allowing to identify the destination of packaged proteins going into the spore. This would aid in the isolation, classification and understanding of secretion methods of different proteins.

**Title: Adapting Synergistic Dopants on CoFe Oxyhydroxides for Enhanced Alkaline and Neutral Saline Water Oxidation**

*Author(s): Ahmed Mohamed, Rana Mohsen, Ebtihal Youssef, Fatma Ahmed, Hania Elsayed*

*Primary URS Faculty Advisor: Abdel-Wahab, Ahmed, Ph.D.*

**Abstract:**

The infamously sluggish oxygen evolution reaction (OER) has been widely accepted as a focal point in advancing and applying water splitting technologies for green hydrogen generation. Whilst the overwhelming majority of work has been devoted towards buffered pure water electrolytes, a growing interest in the field is now emerging towards saline (0.6M NaCl) buffered electrolytic systems – mimickers of real seawater. Investigation of highly electro-active, stable, earth-abundant electrocatalysts in saline electrolytes is seen as a prerequisite to the commercial realization of saline water electrolysis. Initially, we fabricated spinel  $\text{Co}_3\text{O}_4$  through the highly scalable solution combustion synthesis (SCS) to act as the catalyst's core and Co-source. Further, we developed highly modulated S,B-codoped electrocatalysts composed of a trimetallic (CoFe-ETM) oxyhydroxide shells. We incorporated early-transition metals (ETM; Cr, V) as active-site regulating species to enable effective  $\text{Co}^{2+}$  presence during saline water oxidation. The non-metallic dopants were employed to both synergistically enhance activity through surface modulation and offer a highly hydrophilic surface that activates higher performance during near-neutral water oxidation – when  $\text{H}_2\text{O}$  adsorption is the initial OER intermediate. The hydrophilicity of the catalysts corresponded to aerophobicity effects which facilitate rapid bubble rejection during operation which is important at higher current densities. We performed an array of surface chemistry and textural characterization techniques including XPS, SEM, EDX, and Raman spectroscopy in order to effectively investigate the highly active catalysts developed. Pre- and post-OER XPS analyses were undertaken to reveal the changes in surface chemistry of the attained oxyhydroxides after OER operation. The as prepared S,B-(CoFeCr)OOH and S,B-(CoFeV)OOH required low overpotentials of 174 and 242 mV at current density of  $10 \text{ mA cm}^{-2}$ , respectively, in alkaline saline (1M KOH + 0.5M NaCl) electrolyte, with low Tafel slopes of 45.3 and 51.2  $\text{mV dec}^{-1}$  conveying the fast kinetics of the electrocatalysts. Moreover, in order to bring closer the goal of direct seawater electrolysis, we attained polarization curves for the aforementioned electrocatalysts in saline near-neutral (1M Carbonate/Bicarbonate + 0.6M NaCl; pH = 8) and neutral (1M PB + 0.6M NaCl; pH = 7) electrolytes. Chronoamperometry (CA) studies were performed in harsh alkaline saline (4M KOH + 0.6M NaCl) [\[AB1\]](#) and neutral saline electrolytes in order to ensure the oxyhydroxides' chemical stability (i.e., chlorine corrosion) and quantify CER products through the DPD method, respectively. It is our belief that this study provides a systematic approach towards a rational design of highly active and stable electrocatalysts and ensures thorough testing in electrolytic media of commercial significance. [\[AB1\]](#) The results for this is not presented in the paper.

So, either present it and discuss it in the paper or remove it from the abstract.

**Title: Amendment Fever: The Transformation of the Constitutional Amending Process After 1860**

*Author(s): Jillian Long*

*Primary URS Faculty Advisor: Dr. Katherine Unterman, Ph. D*

*Co-URS Faculty Advisor: Dr. Trent MacNamara, Ph.D*

**Abstract:**

Before 1860, U.S. Congressmen proposed an average of 3.5 constitutional amendments per year. The content of these amendments were restrained to issues of federal authority and governmental structure. For instance, the 11th Amendment, ratified in 1795, restricted the jurisdiction of federal courts to hear lawsuits against

state governments brought about by citizens of other states or foreign nations. All moral or social issues were considered matters of the state. However, between 1860-1865, the number of proposed constitutional amendments jumped to over 100 per year. Even more impressive than the sheer number of proposed amendments is the shift in content. In December 1860, 69 of the 89 proposed amendments directly addressed the issue of “slavery” and “domestic institutions,” a subject Congress had never proposed amendments on before. The 1860 slavery amendments were responsible for opening the floodgates to the drastic rise in the number of proposed amendments in future decades. This work analyzes the “Amendment Fever” (1875-1920) that occurred after the Civil War as social reformers began utilizing the Constitutional amending process as a tool to enact change. This paper evaluates the success and failure of three prominent post-Civil War amendment proposal topics - polygamy, temperance, and women’s suffrage - in terms of their purpose of increasing or decreasing social control.

**Title: An Innovative Amino Acid Meat Curing System**

*Author(s): Sarah Bludau*

*Primary URS Faculty Advisor: Dr. Wesley N. Osburn*

**Abstract:**

Sodium nitrite is vital to develop cure color, flavor, provide shelf stability and antimicrobial properties in processed meat products. Consumer demand for natural and organic products has increased due to concerns about the health risks associated with the addition of synthetic additives (i.e., sodium nitrite). Currently, no effective single replacement ingredient possessing the functional properties of sodium nitrite has been identified. The objective of this study was to evaluate the efficacy of an amino acid-based alternative curing system compared to a conventional curing system (direct addition of sodium nitrite). Beef frankfurters containing 156 ppm sodium nitrite (conventional curing) and beef frankfurters manufactured using three amino acid concentrations were evaluated for residual nitrite, cured color intensity, cured color stability, lipid oxidation, volatiles, and aerobic plate counts over a 56-day storage period. This research addresses the safety and quality attributes of a novel “no sodium nitrite” meat curing system. The data collected from the frankfurters with the amino acid curing reagent were similar to the results for (state data-residual nitrite, etc.) conventionally cured beef frankfurters. The results from this study will determine the feasibility of the amino acid based alternative curing system for the commercial manufacturing of processed meat products.

**Title: Analysis of Multi-sensory Tag Data from Fin Whales through Generalized Additive Modeling**

*Author(s): Leah Bogan*

*Primary URS Faculty Advisor: Dr. Ana Širović*

**Abstract:**

Balaenopterids are some of the largest animals ever to have lived on earth, but often the most elusive to research. So much so, we are still discovering new populations and species. As technology and the sciences continue to converge, bioacoustics and associated methods of data acquisition are efficient ways to navigate the challenges of oceanic research. Multi-sensor, bio-logging tags host a suite of observational sensors that allow for remote observation of an animal with little disturbance, save for an initial attachment of the tag. Data acquired from tags can be translated into behavior as well as quantified into vital statistics that inform on individual and population health. Balaenopterids have a distinct way of feeding from other marine mammals termed ram or lunge-feeding which in turn has a distinct energetic signature. Tracking the occurrence of individual lunges can provide parameters on dive efficiency, metabolic rates, feeding ecology and more. Rorquals vary their lunge-feeding seasonally as well as on time of day. In this study, I examined fin whale (*Balaenoptera physalis*) lunging behavior from tag data collected across an eight year period in southern California. A generalized additive modeling framework was used to test the hypotheses that lunge depth (deep, greater than 30 m or shallow, less than 30 m) was dependent on the time of day (day or night) and season (spring, summer, or fall). There was significant difference in the depth of lunge and time of day with deep lunges found to occur primarily during the day and shallow dives at night. Significant seasonal differences in frequency and depth of lunges were also observed, with feeding-lunges increasing in depth and intensity from spring to fall.

**Title: Analysis of a Byzantine-tolerant Algorithm**

Author(s): David Wang

Primary URS Faculty Advisor: Dr. Jennifer Welch

**Abstract:**

In a dynamic system characterized by continuous churn, server and client nodes can freely enter and leave the system. A simulated shared register on top of this environment provides the illusion of shared memory to the system and reduces the difficulty of programming. Shared register emulation; however, must be fault-tolerant, with the value of the shared register replicated on the majority of servers to achieve this. In particular, Byzantine faults, regarded as the worst class of failures describing the arbitrary and unreliable failure of nodes, requires replicating the shared register on more than two-thirds of the servers in the system. In a paper by Kumar and Welch, an algorithm capable of emulating a multi-reader multi-writer atomic register in a dynamic system with Byzantine servers is given with constraints limiting the number of Byzantine servers in the system and limiting the number of changes to the participating server set during a fixed time interval based on total system size. Thus, the primary motivation behind this research is four-fold: to study the performance of the described algorithm, tweak both system and algorithm parameters to test tradeoffs, empirically determine whether the constraints given in the paper are too stringent in practice, and lastly, to look for performance improvements of the algorithm.

**Title: Analyzing TnSeq data to predict insertion counts in M. Tuberculosis**

Author(s): Adlie Brown

Primary URS Faculty Advisor: Thomas R. Ioerger, Ph.D.

**Abstract:**

TnSeq is a genetic method used to evaluate the essentiality of genes in bacteria, such as *Mycobacterium tuberculosis*. It uses random insertions by the Himar1 transposon and high throughput sequencing to determine the most essential genes. The Himar1 transposon only inserts at TA dinucleotide sites in the genome, and it was thought that the surrounding sequence did not affect its insertion preferences. However, recent studies have shown that the sequence surrounding the TA site does affect how likely Himar1 is to insert there. Our goal was to determine whether a model that predicts the insertion count of a TA site in the *M. tuberculosis* given its surrounding nucleotide sequence could be created. To do this machine learning algorithms, including artificial neural networks and naïve bayes classifiers were tuned and tested to make the most accurate predictions. Also, the input and output encodings were adjusted, and supplemental information was added to increase the accuracy of the predictions. In the end, by considering the relative difference between the mean insertion counts of each TA site and the expected counts of surrounding TA sites in addition to the surrounding sequence itself, we were able to use simple linear regression to create a model that has predictive power. We achieved an R<sup>2</sup> value of 0.28, and the scatter plot of the predicted and actual insertion counts showed a linear trend. Our model used the novel approach of considering the context of the surrounding TA sites to generate a more accurate prediction. The model can help scientists better interpret the results of TnSeq experiments. This bioinformatic analysis can help us learn more about bacterial evolution and could help us find essential genes to target when developing drugs to treat tuberculosis.

**Title: Angel Down**

Author(s): L.J. Mokanse

Primary URS Faculty Advisor: Jason Harris

**Abstract:**

My thesis is a novel which aims to tell the story on an angel who is banished from Heaven and goes on a journey to attempt to return. My novel seeks to portray a journey of spirituality and sexuality through the format of the classic Hero's Journey by Joseph Campbell. The use of the Hero's Journey specifically shows growth and change of self/previous biases. My research consisted of fantasy novels, plays, and media which all dealt with angelic narrative. Prior works tend to focus on the religious aspect of biblical tales and do not add much, if any LGBT representation. Novels such as the "His Dark Materials" trilogy by Phillip Pullman and Cassandra Clare's "The Mortal Instruments" series both contain angelic imagery and small cases of LGBT representation. However, both of this series but the representation on the back burner and it is not something

that is integral to the plot of either of the stories but simply something added to give the story more diversity. The problem with doing this is by adding this “diversity” in this way, the full depth of LGBT experiences is not fully conceptualized. The other half of my research dealt with various poets and artists which would help build my style for the poetry which appears in my novel. The inclusion of poetry in my novel is used to show the inner feelings of my character but also to introduce more poetry to a wider young adult audience.

**Title: Antipsychotic drug-induced damage in the basal ganglia as a cause of Parkinsonism: A review of the literature**

*Author(s): Emily Cheong*

*Primary URS Faculty Advisor: Laura Smith*

**Abstract:**

Parkinsonism refers to a set of conditions featuring motor symptoms such as slowness, tremor, and rigidity that are most commonly observed in older patients. Forms of Parkinsonism can be difficult to distinguish clinically, with the two most common being Parkinson’s disease (PD) and drug-induced Parkinsonism (DIP), and are associated with dysfunction in a subcortical brain region known as the basal ganglia, a major motor modulation center. Specifically, the basal ganglia receives dopaminergic projections from the substantia nigra pars compacta (SNc), and reduced dopamine signaling or numbers of projecting neurons lead to Parkinsonism. DIP can be initiated by dopamine receptor blocking agents, including first- (FGA) and second-generation (SGA) antipsychotic drugs, which block D2 dopaminergic receptors. Unlike in PD, motor deficits in DIP may be alleviated upon withdrawal of the offending drug, but in some cases, patients continue to experience Parkinsonism symptoms for years. It is not known whether these more permanent forms of DIP may result from damage in the basal ganglia by FGAs and SGAs. Based on a review of the literature, evidence that prolonged exposure or high concentrations of FGAs or SGAs may promote neuronal dysfunction and induce permanent PD in patients is explored.

**Title: Applying Automated Anomaly Detection to Energy Consumption**

*Author(s): Sixing Zheng, Kyle Hsu*

*Primary URS Faculty Advisor: Dr. Xia Hu, Ph.D.*

**Abstract:**

There is no world without energy. Dependence on energy continues to dominate everything that we do. It is known that any failure in the production of energy can directly affect thousands of lives. Because of this, data is closely monitored and collected. Our research intends to apply Automated anomaly detection to energy performance data to detect degradations in energy consumption. We use a multivariate time series dataset from a six year period of time at a Combined Cycle Power Plant. Anomaly detection is a data analysis method with the purpose of identifying points in data that do not follow the intended behavior of the dataset. These points can be caused by error, technical faults, or bugs that have potentially devastating impacts if unnoticed. Anomaly detection has become more flexible as more methods of data processing, feature analysis, and detection have become available. Although the techniques of anomaly detection have drastically improved in recent years, there has been little research done on automated anomaly detection. Building an anomaly detection system requires an expert to manually select features such as data pre-processing methods and feature analysis methods in order to construct an anomaly detection pipeline that is suitable for the dataset. This method is very costly and can be done with a machine learning approach. With the incorporation of machine learning, Automated Anomaly Detection has the ability to build an optimal pipeline according to the types of the dataset. Instead of wasting time and money manually building possibly unreliable anomaly detection algorithms, the process is simplified by just feeding in the desired dataset to detect anomalies. The system would process the dataset and get information by running the system on the dataset. According to the information, the system would pick different components and build pipelines to check for the accuracy until the best optimized pipeline is generated for the dataset. Our Anomaly detection system construction is built by Time Series Outlier Detection System (TODS) which implements modern machine learning principles to construct an optimal anomaly detection system for our time series dataset. TODS focuses on data processing, time series processing, feature analysis, and detection algorithms to construct an outlier detection system. Utilizing automated anomaly detection methods in monitoring energy consumption can help energy consumers quickly find and fix the degraded parts to minimize consumption and provide more safety to users.



The requirement of an expert in energy performance is no longer needed. The cost of constructing anomaly detection pipelines for industries would significantly be lower as well.

**Title: Applying Deep Learning Methods on Real World High-Throughput Screening Data To Discover Antibiotics**

*Author(s): Robert Tevonian*

*Primary URS Faculty Advisor: Shuiwang Ji, Ph.D.*

**Abstract:**

Antibiotic resistance is a massive problem, and we've fallen short in discovering new antibiotics in recent years. We are no longer able to rely on natural products or high-throughput screening alone. If we do not update these methods, by 2050, the scale of death will be 4 times that of COVID every year. In the 40 years of use of high-throughput screening in antibiotic discovery, zero antibiotics have come to market from this method. Recent advancements in deep learning have provided a potential solution to this problem. It has been demonstrated that with a clean yet relatively small training dataset, meaningful predictions can be made on large chemical libraries. However, relying on cherry-picked data with extremely confident 'hits' or 'misses' fails to represent the uncertainty of large real-world datasets. I propose a new high throughput screening workflow that solves this issue by emphasizing the confidence of 'misses', and samples a broad chemical space. This new method is cheaper, faster, and more confident. I also propose a way to recover the 40 years of unusable data in 1 step -- by screening 'misses' that are near previous prospective 'hits' with confident methods and predicting on their neighbors in chemical space. This ushers in a new broad-spectrum era of antibiotic discovery.

**Title: Aristotle's Causal Framework in Reproduction**

*Author(s): Holden Hill*

*Primary URS Faculty Advisor: Dwayne Raymond, Ph.D.*

**Abstract:**

In the standard literature today, the prevalent view concerning Aristotle's theory of generation in *Generation of Animals* is the argument that Aristotle conceives of a system in which the end goal of generation is the production of the male. This teleological system then would only produce female animals as the result of a failure in the process of generation. This belief has prompted contemporary commentators to charge Aristotle with gender bias underlying his theory of generation. In my thesis, I challenge the standard view of Aristotle's theory of Generation, particularly the 'Degrees of Perfection' model which lies at the heart of the male-oriented teleological conception, an interpretation argued for by Karen Nielsen. I argue that this interpretation is influenced by a Thomistic account of the causes, and does not accurately portray Aristotle's causal framework. As a result, Aristotle's hylomorphism and the role of opposites in his four-causal account are misunderstood and do not play the crucial role Aristotle intends in his theory of generation. I advance the position that Aristotle does not operate on a 'Degree of Perfection' model, but rather in a framework in which opposites anchor a continuum. In this framework, external efficient causation plays more than a passive role in the four-causal account. Without this Thomistic influence that has recently clouded an accurate account of Aristotle's causal framework, I believe there is still a lot to uncover about the relationship of external efficient causation in natural processes.

**Title: Asylum and Femicide: An Analysis of Gendered Concepts of Humanity and its Role in the Northern Triangle**

*Author(s): Nydia Gomez*

*Primary URS Faculty Advisor: Dr. Vanita Reddy*

*Co-URS Faculty Advisor: Dr. Dinah Hannaford*

**Abstract:**

This study examines how women are marginalized within gendered concepts of humanity through the limitations of *femicide* as an unrecognized basis for the credible fear of persecution under human rights regimes in the United States. In the United States, an applicant must have a credible fear of persecution and

be a member of a particular social group. This thesis includes historical and sociological examinations of social unrest in the Northern Triangle that forces migrant women to leave their home country for asylum in the United States, exploration of a male-centric view of human rights, and the way that the permissions of sexual violence being in international institutions affects private life in the Northern Triangle. The following questions guide the study: How does a patriarchal foundation of human rights law perpetuate gender injustices in the Northern Triangle? Moreover, how does the absence of *femicide* as a right-based asylum claim in the Northern Triangle impact how we might think of women as a social group in asylum law? When asylum courts deny claims of women from the Northern Triangle they do so because they do not belong to a particular enough social group that is required for asylum claims, or they are seen as not having a credible fear of persecution. I argue that a patriarchal structure underwrites international human rights law and discredits the severity of sexual violence in the Northern Triangle by reducing inadmissible *femicide* as a credible fear of persecution. Moreover, I examine how the absence of *femicide* and “woman” as a social group in asylum law reinforces the gendered concepts of humanity within the humanitarian discourse that omits the narratives of women who are seeking refuge from the Northern Triangle.

**Title: Before and After Terrorism: Economic and Political Development in the Basque Country**

*Author(s): Jake Shatzer*

*Primary URS Faculty Advisor: Maddalena Cerrato, Ph.D.*

**Abstract:**

The Basque Country, a region along the Spanish-Franco border, has a long history of independence and autonomy. In the modern era, from 1959 until 2011, the domestic terrorist group *Euskadi Ta Askatasuna* (ETA) waged a campaign of political violence primarily concentrated in the Basque Autonomous Community in pursuit of independence from Spain. The group was ultimately unsuccessful and declared a permanent ceasefire in 2011. I find that important political and economic factors contributed to ETA’s prolonged existence. High youth unemployment in the 1980s and 1990s created a large pool of recruits that helped sustain ETA’s campaign. At the same time, ETA’s activities had negative effects on the region’s economy. Basque nationalist political parties also pushed for independence from Spain but sought to do so through established political processes. Despite being officially distinct entities, the “nationalist left” tacitly accepted ETA’s violence for many years and viewed the group as the military wing of the nationalist movement. This support eroded over time as ETA hampered nationalist parties’ ability to further their goals and the electorate’s opposition to the group grew. Ultimately, a loss of support among nationalist left parties led to ETA’s demise and declaration of a ceasefire. Since the ceasefire 2011, there has been increased support for the nationalist left and improvements in the region’s economy.

**Title: Boosting Partial Channel Neural Architecture Search with Gradient Projection**

*Author(s): Ryan King*

*Primary URS Faculty Advisor: Dr Bobak Mortazavi, Ph.D.*

*Co-URS Faculty Advisor: Dr. Zhangyang Wang Ph.D.*

**Abstract:**

Neural Architecture Search has led to the discovery of novel neural network architectures that are capable of outperforming expertly designed architectures with fewer resource requirements at deployment time. Recently, methods have been developed to significantly reduce the computational resources and time required to derive custom neural architectures. Specifically, gradient based methods have leveraged backpropagation to design architectures while a network is being trained, reducing search time from nearly 1400 GPU days to 1. However, differentiable neural architecture search suffers from dominating parameterless operations, steep local minimums, and shallow architectures. A recent multitasking method was able to reduce gradient confliction, dominating gradients and high curvatures within their domain by projecting conflicting gradients from each task onto each other. We utilize a similar method to project conflicting gradients of edges in a search cell. We attempt to avoid the derivation of shallow networks by projecting the gradients of shorter paths onto the conflicting gradients of longer paths to encourage network depth. We show that differentiable neural architecture search can be boosted with the use of gradient projection and partial channel connections. By doing so, we show that parameterless operations and steep local minimum can be related dominating gradients and high curvatures that are overcome in the multitask setting.

**Title: Building Trust: Can Infrastructure Projects Improve Government Trust in Brazil?**

*Author(s): Kelly Krenek*

*Primary URS Faculty Advisor: Guy D. Whitten, Ph.D.*

**Abstract:**

Governments that suffer low levels of citizen trust generally have worse policy outcomes and lower levels of citizen compliance, making it difficult to pursue other policy goals. However, scholarship on government trust is limited and mostly focused on explaining trust in countries that already have higher levels of trust or on comparing countries at a national level. I propose that successful infrastructure development projects, because they are a uniquely visible government policy, serve to increase citizen trust in government within a single country. Using data from the *Luz Para Todos* program in Brazil, which is a federal program that provides electricity to households that lack it, I examine the effects of this particular infrastructure development program on voter behaviors that are associated with trust in government. I expected to find that municipalities that have more recipients of the *Luz Para Todos* program to exhibit greater voter turnout rates in accordance with theorized higher levels of trust. I also expected this relationship to have both spatial and temporal components. Spatially, I expected a greater portion of nearby municipalities that are also beneficiaries of the *Luz Para Todos* program to increase awareness of the project and further improve trust in government. Finally, I expected the effects of the program on government trust to fade over time as citizens use more recent events to evaluate how trustworthy their government is. Preliminary findings suggest moderate support for these expectations.

**Title: Called and Challenged: Examining the Experiences of Women Clergy in Brazos County and Harris County, Texas**

*Author(s): Sarah Rutherford*

*Primary URS Faculty Advisor: Robin Veldman, Ph.D*

**Abstract:**

By the first decade of the twenty-first century, women clergy in many denominations had been able to be ordained for more than fifty years and made up half of qualified seminary graduates. Despite these significant shifts in the realms of policy and education, however, women are still underrepresented as clergy within their respective denominations. Women therefore appear to decline to pursue ordination or to leave pastoral ministry at a higher rate than men. Existing literature suggests three main reasons for women leaving ministry: challenges with hiring discrimination, the pay gap, and various forms of burnout. This study uses qualitative methods to explore the reasons which may lead clergywomen to leave ministry in Brazos County and Harris County, Texas, through open-ended interviews with clergywomen and women who formerly served as clergy. By focusing on clergy within a specific regional context, this study examines the influence of regional bodies and local cultural norms on the experiences of clergywomen. I find that all of the above factors influence clergywomen's choice to stay in or leave ministry and that many women's decisions to leave ministry are based on a combination of these reasons. Drawing on sociological theory that seeks to explain how members maintain evangelical churches as white spaces by enacting "race tests," I suggest that women clergy are subject to similar "gender tests." Though not identical in every way to race tests, gender tests do serve a similar function, which is to maintain predominant norms, in this case related to a gendered conception of the ideal clergy person. The resulting perpetuation of the idea of inherently male clergy exacerbates existing hiring discrimination and congregational bias against women clergy.

**Title: Can Online Trials Be Fair During the COVID-19 Pandemic?**

*Author(s): Travis Steubing*

*Primary URS Faculty Advisor: Linda Radzik Ph.D.*

**Abstract:**

In the year 2020, the United States of America was ravaged by the global COVID-19 pandemic. However, even in a pandemic, crimes are committed, and people are imprisoned. The severely overloaded court system was forced to adapt and continue to adjudicate cases while navigating the challenges imposed by COVID-19. A widely adopted solution that appeared to mitigate the health risks of a highly transmittable disease was the use of Zoom, YouTube, and other video services to hold court and try cases. However, this shift in court

proceedings has revealed a plethora of concerns respecting the rights of those on trial, the state, victims, and more. At the forefront of this discussion is an overarching concern – can online trials be fair during the COVID-19 pandemic? This paper sets out to answer this question, or at least provide clarity and distinctions that will allow the reader to formulate their own opinions with real life implications. To accomplish this task, several steps need to be taken. First, the American standard of fair trials must be examined and analyzed. While there is no comprehensive list of standards, expectations and rights are enumerated within the Sixth Amendment and other statutes. With the characteristics of a fair trial determined, sights are then set to detailing the health and societal concerns presented by COVID-19 and the reasons why online trials are being used to mitigate these risks. Finally, this wealth of information is combined and applied to answer the question – can online trials be fair during the COVID-19 pandemic?

**Title: Cavity Quantum Electrodynamics with Landau Quantized Graphene**

*Author(s): Maxwell Throm*

*Primary URS Faculty Advisor: Alexey Belyanin, PhD*

**Abstract:**

We attempt to see if strong coupling between both a quantum electric field and Landau quantized (LQ) graphene is achievable. LQ graphene acts as a collection two-level quantum bits (qubits). With a classical electric field this coupling between field and qubits gives rise to Rabi oscillations between the two energy levels of the qubits. The cavity we are using to confine the electric field is a photonic crystal cavity with a 2D sheet of graphene sitting between two layers of hexagonal boron nitride (hBN) with distributed Bragg reflectors (DBRs) on the outside acting as mirrors. A better understanding would make it possible for devices to be constructed that implement new principles of telecommunications and computing. For example, quantum computers utilize qubits constructed of the superposition of quantum states instead of classical bits based on electric charge. Quantum computing promises drastic increase in memory density and computation speed. Communications based on the exchange of quantum states of light are inherently secure, because any eavesdropping attempt will destroy the quantum state.

**Title: Changing Attitudes Towards Reparations**

*Author(s): Saron Araya*

*Primary URS Faculty Advisor: Dr. Brittany Perry*

**Abstract:**

Perspective-taking is when an individual takes the point of view of a different, marginalized, or negatively viewed group in order to facilitate an understanding towards their situation and improve the marginalized group's social standing. Many research studies show that perspective-taking can reduce ethnic prejudice, but these scholars focus solely on the *beliefs and feelings* towards this group. This study will expand on this work by using the benefits of engaging with perspective-taking and applying them to not just changing the negative attitudes towards descendants of slaves, but focus on changing the attitudes toward reparations as a public policy initiative. I argue that engaging in perspective-taking of slave descendants conditions attitudes on reparations.

**Title: Characterization of Anti-TcdB DARPins Disulfide Mutants**

*Author(s): Alyssa Low*

*Primary URS Faculty Advisor: Zhilei Chen, Ph.D.*

**Abstract:**

*Clostridioides difficile* (*C. diff*), the microbe responsible for *Clostridioides difficile* infection (CDI), is a common nosocomial infection that exerts its pathogenicity primarily by two toxins, TcdA and TcdB. Designed ankyrin repeat proteins (DARPins) are an emerging approach of protein therapeutics to combat disease beyond the limitations of antibiotics and monoclonal antibodies. Disulfide bonds are commonly used in other facets of protein engineering to enhance stability, but their use has not been well documented with DARPins. Previously, the Chen lab engineered DARPins that have been demonstrated to be effective at neutralizing TcdB. However, these DARPins are not protease-stable, which is a barrier for effective delivery in downstream

therapeutic contexts. To address this, disulfide bonds were introduced in order to increase the stability of the DARPin and thus increase resistance to protease digestion. The subsequent structure, stability, and neutralization activity are assessed to ascertain the effects of bolstering tertiary structure. The formation of disulfide bonds is confirmed by the comparison of mutants in oxidizing and reducing conditions. Elapsed trials with trypsin and chymotrypsin incubation demonstrate protease stability. Overall, the addition of disulfide bonds is demonstrated to improve stability at minimal cost to neutralization activity. The successful characterization of these disulfide mutants may grant continuing insight into future protein engineering applications and aid the development of a therapeutic anti-TcdB DARPin.

**Title: Characterizing the Role of Transcription Factor Hb9 in Glial Cell Development**

*Author(s): Sunjay Letchuman*

*Primary URS Faculty Advisor: Jennifer N. Dulin, Ph.D.*

**Abstract:**

Hb9 (*Mnx1*) is a transcription factor described as a spinal cord motor neuron-specific marker in embryonic development and a critical factor for the post-mitotic specification of these cells. As such, transgenic mice with mutations in the *Hb9* gene are commonly used for the study of spinal cord motor neurons. To date, the expression of Hb9 in other cell types has not previously been reported. We performed a fate-mapping approach to examine the localization of Hb9-expressing cells and their progeny ('Hb9-lineage cells') within the embryonic and adult spinal cord. We found that Hb9-lineage cells are distributed in a gradient of increasing abundance throughout the rostro-caudal spinal cord axis during developmental and postnatal stages. Furthermore, although the majority of Hb9-lineage cells at cervical spinal cord levels are motor neurons, at more caudal levels, Hb9-lineage cells include astrocytes and oligodendrocytes, the macroglial cells of the central nervous system. In the peripheral nervous system, we observed a similar phenomenon with Hb9-lineage Schwann cells present in an increasing rostro-caudal gradient throughout the body. These observations have several exciting implications. Hb9 may play an important role not only in astrocyte and oligodendrocyte development, but also in development of Schwann cells, which are the glial cells associated with the peripheral nerves. Additionally, characterization of Hb9-lineage glial cells may reveal new functional roles for glia throughout the developing spinal cord. Through characterizing the role of Hb9 in glial cell development, describing the molecular pathways involved, and determining the differences in gene expression between Hb9+ and Hb9- spinal cord glial cells, the developmental function of Hb9 can be better understood.

**Title: Civilizations' Origin: A Thought Connection Between Thomas Paine and Jane Addams**

*Author(s): Garion Frankel*

*Primary URS Faculty Advisor: Cary J. Nederman, Ph.D.*

**Abstract:**

As a result of ideological opposition or the reduction of his writing to mere propaganda, the legacy of Thomas Paine within mainstream political theory has remained largely unexplored. Never a friend to the elite or powerful, Paine's torch was carried by the common men, trade unionists and socialists, who found in him a kindred spirit. While his reputation and character have been restored in recent decades, scholars still do not assign his legacy enough value. One avenue of investigation that is not present in the literature is a connection to sociologist Jane Addams, who served as an honorary vice president for the Thomas Paine Monument Association. In particular, Addams' political anthropology bears a number of distinct similarities to that of Thomas Paine, and she applied many of these views through her work at Hull House. Beyond the purely historical connections, these similarities in their respective political anthropologies can also be revealed through thorough examination of both thinkers' accounts of pre-civilization (or the state of nature), the rise of civilization, and how civilization ought to be treated normatively. In this thesis, based on the above revelations, I find that Thomas Paine was a discernible influence upon the political anthropology of Jane Addams.

**Title: Climate Inspired Fictions and Present Obligations to Future Generations**

*Author(s): Gabrielle Doucet*

*Primary URS Faculty Advisor: Dr. Carmela Garritano*

**Abstract:**

Present-day ideals of individual mobility and capitalistic-driven consumption have generated increased air and water toxicity, ocean level rising, and mountains of non-biodegradable plastic. Current energy trends contribute to mass industrialization, globalization, and overproduction issues are disapproved of by activists fighting for a transition to sustainability. Climate fiction, or “cli-fi,” novels advocate for raising awareness and promoting further research into climate issues. The narratives of this genre also present situations that aid in promoting discussion of an ethical transition to a more sustainable environment for present and future generations. The cli-fi novels that are the focus of this thesis - Parable of the Sower by Octavia Butler, American War by Omar El Akkad, and The Wall by John Lanchester - invite readers into an intergenerational conversation about our responsibilities to the planet for future generations. These fictional narratives raise questions on how to best practice a care ethic for the Earth and for the future. In this thesis, I will analyze the ethical questions of these futuristic narratives and draw on the similarities and differences the characters experience in a climate crisis. My central claim is that each novel, through a young protagonist’s view, shines a light on the intergenerational conflict and provides an opportunity to debate implementing an ecological ethic of care for the future.

**Title: Closed Captioning for In-Person Lectures to Assist Students with Learning Disabilities**

*Author(s): Aditi Panchal*

*Primary URS Faculty Advisor: Tracy A. Hammond, Ph.D.*

**Abstract:**

A significant portion of the student population is affected by learning disabilities in the United States, and many of these disabilities are not accommodated for in schools. Additionally, many children with attention deficit hyperactivity disorder (ADHD) and/or dyslexia have coexisting auditory processing disorder (APD), a condition that makes it more difficult to recognize subtle differences in the sounds of words. Many of these issues directly impact students’ performance in school, but these students are often not provided adequate support for coping with these circumstances, yet are expected to perform at the same level as other students. Visual aids for learning are powerful tools and are often utilized as supporting images in textbooks and lectures, yet the current visual support for verbally relayed information may not be as comprehensive as necessary to ensure a level playing field for all students. A mechanism for providing real-time captions of in-person lectures in schools and universities would help students not have to rely on auditory instructions alone, but also be able to simultaneously reference speech-to-text output, and doing so from a mobile application ensures convenience, portability and quality. Additionally, the use of such an application would help reduce inherent discrimination in education that bars students with learning disabilities from equal access to information in the classroom setting.

**Title: Cloud-Based FPGA Hardware Security**

*Author(s): Rohith Ramanujam Kumar*

*Primary URS Faculty Advisor: Kevin Nowka*

*Co-URS Faculty Advisor: JV Rajendran*

**Abstract:**

Cloud compute is an opportunity that has been in the public consciousness for some time now, however more recently we have tried to introduce FPGA’s into cloud-based systems. This offers the advantage of parallelizing a workload and results in substantially higher output per voltage. However, FPGA’s have several security vulnerabilities as they can be exploited to shut down systems or to gain unauthorized access to models of other clients running on the same platform. This research is important in the cloud compute space as FPGA’s have the potential to substantially speed up server performance per Watt but currently, the security risks are vast. By removing these exploits, clients may be more willing to send sensitive tasks into the cloud thus reducing client hardware costs and hosts stand to increase revenue stream. In this project, we will attempt to replicate a cloud-based FPGA system using a Stratis V FPGA. We will use this system to run an ML model and

then run an attack in order to steal the model or to disrupt the function of the FPGA itself. Finally, we will attempt to create a defense of the FPGA system.

**Title: Clustering Based Deep Learning Approach to Represent Flamelet Tables**

*Author(s): Sarvesh Mayilvahanan*

*Primary URS Faculty Advisor: Dorrin Jarrahbashi, Ph.D.*

**Abstract:**

This research describes and evaluates a novel unsupervised learning based clustering approach to represent flamelet tables. The typical tabulation method for flamelet based modeling generally requires a large amount of storage, however a well developed machine learning model can accurately represent these models while taking up significantly less storage. The proposed method utilizes a mixture of experts technique where specialized deep neural networks are trained on different parts of the input space. This identification of combustion manifolds within the input space is accomplished through the use of an unsupervised learning based clustering algorithm, which is able to categorize an input to a specific cluster. Previous studies have shown that developing specialized models can lead to higher accuracy and faster speeds. However, the clustering techniques utilized in these studies do not investigate an unsupervised learning approach. The proposed model is trained and evaluated on 5-dimensional flamelet tables, and an investigation of clustering techniques and optimal number of clusters is also conducted. This research project shows that unsupervised learning based clustering algorithms coupled with a mixture of experts framework of Deep Neural Networks can accurately predict temperatures and mass fractions from flamelet tables.

**Title: Collaborative Robotic Motion Planning Between Multiple Arms**

*Author(s): Marc Riccione*

*Primary URS Faculty Advisor: Shawna Thomas*

**Abstract:**

Motion planning simply stated is defined as finding a collision-free path between a start and a goal for a movable object, such as a robot. Motion planning is often applied to interactions between robot arms, or between a human and a robot arm in constrained spaces such as those in a factory. A method to solve these problems is presented by combining the solution to constrained spaces, Reachable Volumes and the solution to multiple interactions, Interaction Templates. This integration is done by replacing the motion planning algorithm that is utilized in Interaction Templates with the algorithm for Reachable Volumes. This integration was demonstrated in a virtual environment that was created specifically for motion planning. Experiments were run on three different methods, Interaction Templates, Reachable Volumes, and the proof of concept that integrates the two methods. These demonstrate the effectiveness of the method when compared against the prior two works standalone.

**Title: Congressional Strategic Communication in a Foreign Policy Crisis: A Study of Benghazi**

*Author(s): Rachel Roberts*

*Primary URS Faculty Advisor: Johanna L. Dunaway, Ph.D.*

**Abstract:**

The 2012 attacks on the U.S. Mission in Benghazi, Libya, caused a lasting impact on U.S. politics continuing today. However, little research regarding how the attack came to create such an impact, has been conducted. By conducting a qualitative analysis of statements made by congressional leadership and comparing it to televised news coverage, I answer two questions; Which U.S. political party within Congress was more successful at implementing their strategic communication goals in response to the 2012 attack on U.S. Mission in Benghazi, Libya? And, within the two parties, which one maintained a more united communication front? Previous research conducted shows that Republicans have a historic hold on matters of foreign policy. Additionally, media traditionally takes its cues from politicians when deciding what subjects to cover. My hypothesis predicts that Congressional Republicans were more successful and united in their goals.

**Title: Consensual Trafficking: Human Capital and the Domestication of Mail-Order-Brides**

*Author(s): Zoe Simmons*

*Primary URS Faculty Advisor: Vanita Reddy, Ph.D.*

**Abstract:**

Through the frameworks of feminist and Marxist theory, I aim to redefine the relationship of Filipina mail-order-brides to capitalism by arguing that their skill of domesticity and sexual servitude qualify as “surplus labor,” according to Marx’s own definition. Recognizing the absence of discussions of labor as gendered and sexualized in Marxist thought, I argue that Marx’s theoretical frameworks are still valuable in conceptualizing the experiences of Filipina mail-order-brides. Moreover, I describe how these experiences can be understood as what I term “consensual trafficking,” wherein Filipina women knowingly enter into contractual marriages in which domestic and sexual servitude are expected of them with the hope of receiving socioeconomic benefits in exchange for these forms of labor. As the domestic and sexual labor of mail-order-brides is expected throughout the duration of their marriages, I argue that this labor can be understood within the frameworks of Marx’s theory of “surplus value,” where the manufacturing costs of a product are low in comparison to the profit earned through the sale of that product. By utilizing this theory, I describe how the initial monetary “investment” of American men into their marriages is eventually surpassed in value by the domestic and sexual labor of the foreign wife. This labor establishes the Filipina mail-order-brides as human capital- a product capable of being exploited by their husbands under capitalism and the Western patriarchy. Overall, I re-examine Marx’s compatibility with feminist theory while furthering feminist discussion of mail-order-bride conjugal relationships as well as the gendered and sexual violence present within these unions.

**Title: Consumer Choice and Control Across State Plans for Independent Living**

*Author(s): Yasmine Kayali*

*Primary URS Faculty Advisor: Tracie Harrison, Ph.D, RN*

**Abstract:**

Independent living services are funded by the Administration for Community Living. Designated state agencies carry out these services and are required to submit state plans for independent living every three years to maintain their state’s funding. This study aims to determine which state plans promote the independent living philosophies, as required by the ACL. An evaluation of state plans’ inclusion of IL philosophies, specifically the consumer choice and control philosophy, concerns the coherency of IL services state to state as well as states’ eligibility for ACL funding. The results of this paper indicate disparities in consumer control initiatives across states, with approximately only half of all states promoting ACL-consumer control initiatives in their plans. We suggest further, more frequent evaluation of independent living programs and their state plans to protect the consumer control priority.

**Title: Copyright Law, Creativity, and Music**

*Author(s): Luke Brock*

*Primary URS Faculty Advisor: Dr. Andrew Morriss*

**Abstract:**

Legal application of copyright law is currently failing to address the advancing technology being used to produce music. We have moved into the age of digital sound production which has given artists new tools that Mozart and Bach never dreamed of. The mal-adjustment of the law to modern-day musical production only makes sense if you take into consideration that the first laws on the subject were put in place to be applied to literature not looping. Furthermore, cultural hierarchies surrounding the art form and false narratives that romanticized author(s)hip in the 18<sup>th</sup> and 19<sup>th</sup> centuries have stunted the growth of the law. While legal scholars like Dr. Olufunmilayo B. Arewa have done a great deal to bring these issues to light, I believe that the underlying cause of copyright shortcomings in the modern music industry is an obvious yet very complex culprit. My belief is that conceptualizations of creativity, originality, and the creative processes in the making of music have become misshapen. By studying and applying Psychologist Dr. Mihaly Csikszentmihalyi’s work on the subject, we will be able to supplement the law by introducing a more accurate depiction of creativity and the creative process.



**Title: Corporate Impunity for Environmental Harms: A Case Study for Mining in Peru**

*Author(s): Lizbeth Hernandez*

*Primary URS Faculty Advisor: Dr. Linda Radzik*

**Abstract:**

My research question is, "How can we best protect against corporate impunity for environmental harms?" This is an important question given that we are experiencing a time where corporate impunity in regard to environmental harms is a globally prevalent occurrence. Specifically, I will look into this problem by focusing on mining companies in Peru. The continuation and complexity of these cases allow for suggested solutions to take into account a variety of variables to ensure they will work on any cases. Mining also occurs globally at different levels of environmental protection depending on the country. By clarifying the nature of the problem, we will establish a clear legal duty and explore what our options are for enforcing that duty. Previous research has looked at the legal debates separately. Building on this, I will incorporate the legal analysis of different arguments for corporate accountability and test them against Peru's corporate impunity. My expected outcome is to clarify the nature of the problem and evaluate alternative solutions.

**Title: Cyber-Physical Defense in Smart Distribution Networks**

*Author(s): Safin Bayes, Leen Al Homoud, Rinith Reghunath*

*Primary URS Faculty Advisor: Robert S. Balog*

**Abstract:**

The existing electric grid is transitioning to a smart grid with increased penetration of distributed energy resources (DERs), such as photovoltaic (PV) units, battery storage units, electric vehicles (EV), and EV chargers. DERs facilitate the increase in renewable energy generation, which leads to a more sustainable, efficient, and reliable grid paradigm. However, with the rise of communication exchanges and data flow due to DERs, cybersecurity vulnerabilities arise. Much of the literature has focused strictly on mitigating data attacks resulting in non-technical losses, false state estimation, and inaccurate load forecasting. However, the grid paradigm's cyber-physical security also needs to be taken into account to ensure that no grid operations take place that impact the physics of the system. Our project will achieve that by developing a Machine Learning (ML) algorithm that will detect anomalies in the commands issued to the distribution network's assets. The algorithm will be trained using data from a base case obtained from the simulation of a distribution network. We will test and improve the algorithm on modifications to the base case.

**Title: Decellularized Liver Biomatrices as a Model for 3D Cancer Metastasis**

*Author(s): Heather Farris*

*Primary URS Faculty Advisor: Shreya Raghavan, Ph.D.*

**Abstract:**

Ovarian cancer is metastatic at the time of diagnosis, with the liver being the most common site of metastasis. Current treatments for ovarian cancer liver metastasis are ineffective at sustaining remission, so new nano-immunotherapies need to be developed. Conventional metastasis/invasion assays do not recapitulate the native tumor primary or metastatic microenvironment, and hence do not predict drug efficacy very well. Therefore, decellularized liver biomatrices are an attractive alternative for in vitro drug screening to provide a more accurate 3D model of the metastatic microenvironment. Liver biomatrices were manufactured via sectioning and decellularization with a Triton X-100 and Ammonium Hydroxide detergent solution. The decellularized liver biomatrices were evaluated using scanning electron microscopy, DNA quantification, and histology to verify that the native cells had been successfully removed. Ovarian cancer cell (OVCAR-3) spheroids were then cultured with and without macrophages and seeded onto the biomatrices to simulate metastasis. Cell migration into the biomatrix was monitored at various time points to collect data indicating the influence of macrophages on the invasive properties of ovarian cancer cells. Samples were imaged using scanning electron microscopy and then analyzed with ImageJ software to quantify and compare ovarian cancer cell invasion over the different conditions. Current SEM and histology data show the decellularization of the liver biomatrix. The decellularized liver biomatrix can be used as a 3D model of the hepatic tumor

microenvironment for nano-immunotherapy for ovarian cancer liver metastasis as well as other forms of liver metastasis.

**Title: Deep Ocean Current Variability Near the Macondo Oil Spill Site**

*Author(s): Hannah Diaz*

*Primary URS Faculty Advisor: Dr. Steve DiMarco*

**Abstract:**

Six deep ocean current mooring systems were deployed near the Macondo (Deep Water Horizon; DWH) spill site in 2012 for a period of 2 years for the purpose of defining the oceanographic current variability within the region and relate to oil spill transport prediction. I will analyze these data to produce climatological maps of ocean current speed and direction that characterize how the ocean moves as a function of depth and season (i.e., time). Progressive vector diagrams and ocean current stick plots will be principal data products that I will create and utilize to analyze the ocean current variability throughout this study. I hypothesize that there are statistically significant differences between surface and deep currents in the vicinity of the spill site which led to different fates of the oil spill remnants that remained subsurface as opposed to those that rose to the ocean surface. This analysis will have important implications for future oil spill response and mitigation in the deep ocean.

**Title: Designing a High Throughput Queue**

*Author(s): Reginald Frank*

*Primary URS Faculty Advisor: Dr. Dmitri Loguinov*

**Abstract:**

Multi-Producer Multi-Consumer (MPMC) Queues are the most natural way to solve the common parallel programming Producer-Consumer Problem. The problem arises when a group of entities need work to be done, and another group of entities are responsible for doing said work; the problem is then how should work be allocated to the workers such that neither group is hindered by the communication required for work allocation. MPMC Queues can solve the problem of allocation by functioning as a global location for work requests to be posted by the former group and later removed to be acted on by the latter group joining the two, but as the amount of work to be done by a system increases, this singular connection can easily become a bottleneck preventing work from being done. Current high performance MPMC Queue implementations strictly enforce that work posted first will be scheduled to a worker first, and while this improves the latency of a system, it can greatly decrease the overall work throughput, crippling bulk data-processing application performance. This project aims to create an MPMC Queue that is focused on overall throughput and investigate what performance optimizations can be made by sacrificing the standard latency guarantees.

**Title: Detect Shaking Head in YouTube Videos**

*Author(s): Yingtao Jiang*

*Primary URS Faculty Advisor: Anxiao Jiang, Ph.D.*

**Abstract:**

This thesis callbacks what has done in the project of creating an action detector to YouTube videos by deep learning and other tools and what is expected to be done in the future. The action specifically is "shaking head", which was the focus of the detector. So far, most of the work is done by using existing ideas to make things worked. In the future, it is expected to improve the detector by trying some techniques like multi-threading. In general, a detector is built and tested. There were 550 videos been detected and more than 5,000 moments were found. However, the accuracy needs to be further improved. The false-positive rate is 41.2%, while the false-negative rate is 10.4%. My algorithm has the potential to detect 336 YouTube videos with 200 to 300 seconds in 1 hour. The algorithm used simultaneously detection which detects the video right after it is clipped, and it does not need to download the videos, which saves a lot of time.

**Title: Detecting COVID-19 Outbreak with Anomalous Term Frequency**

*Author(s): Yile Chen*

*Primary URS Faculty Advisor: Xia Hu, Ph.D.*

**Abstract:**

Previously many studies have aimed at predicting the trend of disease through time series forecasting using machine learning methods. However, data extracted from the real world is often noisy, which can pose numerous challenges for directly predicting the trend, and therefore leading to suboptimal prediction results. Furthermore, real-world data is usually very large, that is, having very long time periods. When it comes to data of such scale, trend forecasting becomes intractable even to state-of-the-art forecasting algorithms such as RNN-LSTM. In the past, few pieces of research have been conducted in applying outlier detection for disease outbreak detection. Consequently, in this research, we propose redefining the problem of disease forecasting into outbreak detection, which aims to predict whether a future point is/is not a sign of a large-scale disease outbreak. By simplifying a complex regression problem into an outlier detection problem, the requirements of the learning model may be decreased and therefore the learning performance may be enhanced.

**Title: Development of MEMS-Based Surface Gravimetry for Solar System Exploration**

*Author(s): Chandler Lawson*

*Primary URS Faculty Advisor: Dr. Michael E. Evans*

**Abstract:**

Gravimetry, the precise measurement of local gravitational accelerations, can be used to probe the subsurface of planetary crusts. The majority of gravity studies on bodies other than the Earth have been constrained to orbital surveys, limiting the resolution of the data to several kilometers. Collecting data on or near the surface would allow for higher resolution data to be collected and the ability to resolve finer scale crustal structure. On the Earth's surface, such surveys are performed using a device known as a gravimeter. Traditional gravimeters are relatively massive and expensive, limiting their suitability for Solar System exploration; thus, a cheaper, lighter alternative is desirable. NASA has developed an instrument that supports the development of such devices based on a micro-electromechanical systems (MEMS) design. The instrument, named HELIX, includes a MEMS inertial measurement unit that contains a precision accelerometer triad. The overarching goal of this project is to aid in the maturation of MEMS gravimeters for Solar System exploration currently under development. Here, calibration procedures developed for the HELIX instrument and plans for a field tests will be discussed in addition to the implications of this project with regard to the future of planetary surface gravimetry and Solar System exploration.

**Title: Domain-Based Isolation with Single-Context Trusted Execution Environments**

*Author(s): Pablo Say*

*Primary URS Faculty Advisor: Dr. Chia-Che Tsai*

**Abstract:**

This presentation overviews the NesTEE libOS prototype, documenting the design choices and feasibility of the proposed system. Currently, Intel Software Guard Extensions (SGX) does little to offer hardware protections for multiple users on the same machine. NesTEE libOS modifies Intel SGX by adding additional trust levels and a refined control flow of data moving in and out of the secure enclave. Designing NesTEE libOS with more security subdomains is a crucial step towards expanding SGX to support towards methods like multitenancy.

**Title: Duration of survival of the Chagas disease parasite (*Trypanosoma cruzi*) in deceased triatomine 'kissing bug' vectors**

*Author(s): Kaitlyn Perez*

*Primary URS Faculty Advisor: Sarah A. Hamer, MS, PHD, DVM, DACVPM*

**Abstract:**

The longevity of *Trypanosoma Cruzi* is essential underlying knowledge for much of the research regarding Chagas Disease and implementation of preventative measures. Understanding the circumstances under which *T. Cruzi* can survive is imperative, especially when management is concerned. The objective of this experiment was to determine the longevity of survival of *T. Cruzi* inside of dead *Triatoma gerstaeckeri* for three periods of time, in order to determine the point at which the parasite is no longer pathogenic. In six trials, nine *Triatoma gerstaeckeri* nymphs were experimentally infected using blood spiked with the protozoan parasite, *T. Cruzi*. Following a positive PCR test for *T. Cruzi*, the bugs were entered into the trial and subsequently decapitated. Group one, containing three bugs, was used immediately to inoculate cultures with fecal sample and a portion of gut material. The remainder of bugs in groups two and three were left out for twenty-four or forty-eight hours before being inoculated into culture. There have been positive cultures that indicate *T. Cruzi* can survive in a dead triatomine for up to forty-eight hours. Data suggests that the death of *T. Cruzi* inside the gut material of a deceased bug occurs at some time point after forty-eight hours. Further trials will explore time points beyond forty-eight hours to see if a determination can be made regarding when *T. cruzi* is no longer viable.

**Title: Dynamatic: An OpenMP Race Detection Tool Combining Static and Dynamic Analysis**

*Author(s): Matthew Davis, Dylan Theriot*

*Primary URS Faculty Advisor: Dr. Jeff Huang*

**Abstract:**

Data races are a type of bug in concurrent programming which can result in unexpected program behavior. When multiple threads modify the same memory location in parallel, a data race occurs. Detecting these races is a difficult problem that becomes unrealistic for a programmer to perform at a large scale. Thus, automated data race detection has a large importance on fixing and verifying the correctness of parallel program behavior. There are two main types of data race detection: static and dynamic. Each analysis has its own set of limitations, and tools utilizing one type of analysis suffer from these drawbacks. We present Dynamatic, a hybrid race analysis tool which builds off of HPCRace for static analysis and Google's Thread Sanitizer for dynamic analysis. Dynamatic performs analysis on C++ and Fortran code that is compiled down to LLVM's IR. In particular, Dynamatic analyzes programs utilizing the OpenMP API for parallelization. The tool is able to leverage the best elements of both types of analysis - the level of coverage that static tools provide, and the low false positive rates of dynamic tools. Thus, the tool is able to mitigate these drawbacks through its hybrid approach and analysis optimizations. Dynamatic efficiently and accurately detects data races in OpenMP programs and is competitive with tools such as Archer, ROMP, and Coderrect on benchmarks.

**Title: Effectiveness of Daylight Replication in Virtual Reality**

*Author(s): Liam Bessell*

*Primary URS Faculty Advisor: John Keyser, Ph. D.*

**Abstract:**

This paper explores ways of letting users interact with daylighting spaces in a virtual reality (VR) environment. Two methods for viewing daylighting in VR are presented, both of which use a physically-based raytracer to generate daylighting images and a game engine for viewing them. The first method generates a 360 degree panorama of the space at a particular point. This is then extended to generate multiple renderings from different locations in the scene, allowing the user to view the space from different angles. The second method creates a texture for each polygon face in the scene. This approach allows users to walk around the scene but comes at the cost of losing the specular component of the textures.

**Title: Effects of Exercise on Mental Cognition**

*Author(s): Amanda Mockaitis*

*Primary URS Faculty Advisor: Richard B. Kreider*

**Abstract:**

Like many other Kinesiology experiments, the relationship between exercise and mental cognition has been researched in many different settings. However, few researches have been conducted on determining a specific type of exercise, anaerobic or aerobic exercises, that shows the best positive increase on mental cognition. This series of manuscripts dives into the ins and outs of exercise as it relates to mental cognition to best narrow down exercises that show the most improvements. Three manuscripts are written on different subjects that all relate to each other in an overarching theme, cognition. The types of exercises (aerobic and anaerobic) were measured using their biological effects on the brain and the body. Further research was done in the exercise and mental cognition to determine the correlation between the biological effects on the brain and mental improvement in certain brain areas. These manuscripts support the feasibility to conduct further research in this field and what important areas to focus on. Because there is substantial research supporting the theory that exercise improves mental clarity, new topics such as specific exercises are important to discover. This new research can shed a new light on ways to improve mental cognition for children and adults of all ages.

**Title: Effects of Host/Graft Sex Mismatch on Survival and Integration of Neural Progenitor Cell Grafts for Spinal Cord Injury**

*Author(s): Michael Pitonak*

*Primary URS Faculty Advisor: Jennifer N. Dulin, Ph.D.*

**Abstract:**

Spinal cord injury (SCI) is an extremely devastating injury that can result in complete loss of all motor and sensory functions. Numerous studies have shown cellular transplantation of neural progenitor cells (NPCs) has great promise in restoring lost neural circuitry following SCI. Unfortunately, little is understood of the biological factors that determine the success of the transplanted graft. One of these is the role of sex as a biological variable. We sought to determine whether sex mismatch between graft and host tissue influences the survival, differentiation, and integration of transplanted NPCs in a mouse model of SCI. Donor sex was determined for individual GFP+ mouse embryos through rapid genotyping of the X chromosome gene *Rbm31x* and its divergent Y chromosome gametolog *Rbm31y*. Either male or female NPCs were then isolated and acutely transplanted into lesion sites of either male or female adult mice. Four weeks following the transplantation, we analyzed neuron and astrocyte differentiation, glial scar formation, and extension of graft-derived axons. Although, we did not detect any significant differences in these areas, we observed significant hypervascularization in grafts derived from male NPCs within female host animals. This observed vasculature was also associated with abnormally high levels of perivascular density only in this treatment group. Immunohistochemical analysis revealed increased levels of infiltrating immune cells, including leukocytes and other types of macrophages, in and around the male-to-female grafts. Altogether, these findings suggest that expression of sex-specific antigens on male donor cells may provoke an inflammatory response in female host animals. Current work involves identifying the specific cell types of infiltrating immune cells and quantifying the extent of the perivascular density along with the diameters of blood vessels seen in the grafts.

**Title: Effects on Income Inequality in School Funding Across Texas**

*Author(s): Paola Loera*

*Primary URS Faculty Advisor: Dr. Florian Hollenbach*

*Co-URS Faculty Advisor: Dr. Brittany Perry*

**Abstract:**

Previous work has shown that there are large amounts of disproportion in public school funding across the nation, and how it affects property taxes in Texas. However, there has been very little research done on how a public school being placed in a low-income community can affect the funding. The focus is placed on public schools with a high enrollment of children of Color, and if they are affected greater than schools with lower

enrollment of children of Color. Through my research I hope to find whether children of Color are being affected greater by disproportionate public school funding.

**Title: Electricity Price Forecasting for Deregulated Energy Markets: Generative Adversarial Network-Based Deep Reinforcement Learning**

*Author(s): Ali El Assadi*

*Primary URS Faculty Advisor: Prof. Haitham Abu-Rub*

*Co-URS Faculty Advisor: Eng. Mohamed Massaoudi*

**Abstract:**

Electricity Price Forecasting (EPF) plays a vital role in smart grid applications for deregulated electricity markets. Most of the studies tend to investigate the electricity market influencers using forecasting techniques, often losing sight of significance on the sensibility of EPF models to the unstable real-time environment. This project will address a novel EPF based on deep reinforcement learning. The proposed approach uses generative adversarial networks (GAN) to collect synthetic data and increase training set effectively and increase the adaptation of the forecasting system to the environment. The data collected will be fed to a Deep Q learning to generate the final predictions. The proposed GAN-DQL will also be assessed on real data to prove the proposed model advantages compared to several machine learning solutions.

**Title: Engineering Ubx-based Fusion Proteins to Promote Growth Cone Extension following Peripheral Nerve Injuries**

*Author(s): Brandon Look Fong*

*Primary URS Faculty Advisor: Sarah E. Bondos, Ph.D*

**Abstract:**

The extension and reconnection of a distal nerve growth cone to a proximal nerve ending following peripheral injury requires complex biomolecular interactions and a conduit that maintains an environment complementary to regeneration. Molecules involved in this interactions are used in artificial conduits but diffuse readily when implanted. We propose the use of the *Drosophila melanogaster* Hox Protein Ultrabithorax (Ubx) because Ubx materials spontaneously self-assemble in mild buffers. This allows us to covalently attach active functional proteins at high concentrations through gene fusion. Ubx fibers have mechanical properties that can be tuned to match native nerves, they are electrically conductive, and fusion protein gradients can be made. Ubx fibers have a high affinity to Early differentiated 6J neural stem cells similar to native elastomeric extracellular proteins. Testing is underway to determine if Ubx fiber resistance to matrix metalloproteinase can be tuned since the environment post peripheral nerve injury is highly degenerative. Our early data indicates Ubx materials may be useful in the extension and guidance of the growth cone.

**Title: Ethical Memory and The Bracero Program**

*Author(s): Jacqueline Garcia Munoz*

*Primary URS Faculty Advisor: Dr. Linda Radzik*

**Abstract:**

We live in a country where many minorities have experienced vast oppression and little to nothing has been done to acknowledge the effects this has had on the coming generations. Recently, movements have helped to shed light on the fact that there are remnants of injustice still living today and that oppression is very much still present. It seems a lack of acknowledgment of this trauma is not allowing us as a country to move forward. This is an important issue that needs to be addressed, therefore I propose to answer the following question: Why should the Bracero Program be remembered in America? By touching base on oppression faced by one minority group, the Mexican American community, and covering what ethics of memory might look like for this group it might inspire or demonstrate how someday this could be applied to all groups alike who have been targeted in this country. This dives into why Mexican Americans and Non- Mexican Americans alike should remember and how to properly do so. It takes a look at a traumatic event from the past and how this has effects in the coming generations due to the lack of correct acknowledgment of it.

**Title: Examining the Biochemical Activity of Anti-CRISPR Protein, AcrIIA7**

*Author(s): Negar Koupaei*

*Primary URS Faculty Advisor: Soo Hyun Yang*

**Abstract:**

Bacteria are constantly exposed to microbes and bacteriophages. The race between bacteria and phages resulted in the development of evolutionary mechanisms to prevent infections in bacteria including the CRISPR-Cas system. In return, phages have developed anti-CRISPR activities to reduce CRISPR-Cas proteins' effects. The CRISPR technology can be used to edit DNA/RNA sequences. However, this editing might cause accidental changes in the genome as a result of off-targeting. Therefore, developing a method to allow precise editing of DNA/RNA sequences is critical. ACRs are used as a method to precisely control the DNA/RNA editing of CRISPR enzymes that can minimize the side-effects of off-targeting. There are several genes that have anti-CRISPR proteins (ACRs) activity. Among those, AcrIIA7 was shown to exhibit a strong inhibitory effect on Cas9 in vitro. The overall goal of this project was to examine the biochemical activity of the AcrIIA7 on inhibiting the DNA or RNA processing activities of the CRISPR Cas nucleases. The experimental aims of this project are: 1. To clone the genes coding for the AcrIIA7 anti-CRISPR proteins into the 6XHis-TwinStrep-SUMO-pET19b E.coli expression vector via Gibson Assembly, 2. To optimize the expression and purification condition of the recombinant AcrIIA7 protein, 3. To examine the inhibitory effect of AcrIIA7 on the DNA/RNA processing activities of Cas nucleases. The results of this project could be used to study the effect of anti-CRISPR in inhibiting/removing off-targeting Cas nuclease and potentially become an applicable method to treat genetic disorders.

**Title: Exploring Psycholinguistic Features Related to Public Speaking Anxiety**

*Author(s): Jasmine Leu*

*Primary URS Faculty Advisor: Theodora Chaspari*

**Abstract:**

People have to present projects or findings publicly multiple times in their lives, whether that be for school, research, or work. Yet, most people carry a social phobia for speaking publicly, which can cause problems throughout their lives if not managed appropriately. This phobia is known as public speaking anxiety (PSA). This study aims to develop machine learning models and algorithms to find features that relate to PSA. Specifically, it investigates self-reported measurements and psycholinguistic datasets that are related to PSA. In this context, correlation is defined as a Pearson correlation coefficient near  $\pm 1$  between two given variables and a P-value near 0. Participants in this study were asked to read an assigned article and to discuss it in front of either a real-life or a virtual audience. Audio recordings were taken from these participants while they presented. The participants were also asked to self-report their State-Anxiety Enthusiasm (SAE) after their public speaking encounter. Audio recordings from all participants were manually transcribed into a readable text format and subjected to psycholinguistic analysis. Findings from this study will determine which features are most related to PSA, enabling researchers to better understand the causes of PSA and the factors that are most related to it. As a result, people will be able to learn about deficits in their public speaking skills and can thereby work on the areas that need improvement.

**Title: Extremism Video Detector**

*Author(s): Akash Rao*

*Primary URS Faculty Advisor: James Caverlee*

**Abstract:**

Social media has grown to become a fundamental part of our lives over the past two decades and with its growth, the misuse of the platform for extremist purposes has become common. The wide reach of social media has allowed extremist groups to take advantage of the platform to spread terrorist propaganda and fear. Therefore, the need for a robust extremist detector in social media is evident.

As an attempt to combat this problem, we present techniques to detect various forms of extremism in videos crawled from Twitter, a microblogging website. We build upon existing deep neural networks used for action classification and create a model capable of recognizing certain common extremism types. We then use this

model against a sample space of roughly 2 million videos to test the accuracy of the model and produce a data set useful for further research in this domain.

**Title: Finding Extreme High-Redshift Galaxies Using the 3D-HST Survey**

*Author(s): Julia Tiller*

*Primary URS Faculty Advisor: Casey Papovich, Ph.D.*

**Abstract:**

In the very beginning stages of the universe, stars and galaxies began to form in their neutral intergalactic medium (IGM) of Hydrogen. Because these galaxies are clouded in their IGM, Lyman- $\alpha$  emission lines are absorbed and obscured as a result. But with the 3D Hubble Space Telescope Survey (3D-HST Survey), we can use its large photometric selection of approximately 100,000 galaxies and low resolution grism slit-less spectroscopy to probe these distant galaxies. The survey allows us to take near-infrared spectra of many objects simultaneously, generating the deep data needed to find a selection of high redshift candidates. A novel method is introduced to detect and quantify faint emission lines by using Bayesian techniques. Previous work was done to systematically analyze the 100,000 galaxies, and a preliminary set of 29 promising candidates were presented. In order to remove false positives from this selection, we validated the input photometry through an updated version of EAZY, and compared with the image cutouts of each of these objects, along with the previously obtained grism redshifts. Of the preliminary 29 galaxies, 22 were promising candidates and 7 were removed as false positives. Further analysis and spectroscopic confirmation are needed to fully vet this method for future grism based missions.

**Title: First Year Eats: Can it Boost Morale and Academic Performance?**

*Author(s): Michael Lee*

*Primary URS Faculty Advisor: Alan R. Dabney, Ph.D.*

*Co-URS Faculty Advisor: Sumana Datta, Ph.D.*

**Abstract:**

The First Year Eats Program (FYE) provides first-year university students among select dorms across Texas A&M University with the option to participate in learning about and taking with them nutritious and delicious recipes including the ingredients to their dorm rooms. By comparing students with similar demographics in the same dorms who did not participate in FYE to students who participated, we wanted to note any significant results between the two populations in terms of their academic success measured by their GPA scores as well as the retention rate along with their mental health which was measured by two surveys: The Perceived Stress Scale (PSS) and the University Belongingness Questionnaire (UBQ). Both last academic year's batch of FYE students and this academic year's batch of FYE students have been investigated in this project. Comparing the midterm GPA scores for last year's students FYE vs. NFYE (Non-First Year Eats) have shown that FYE students showed a statistically significant increase from their Fall 2019 Midterm GPA scores to their Spring 2020 Midterm GPA scores while NFYE students did not show any significant increase to their GPA scores within the same time. For students this year, results have shown that those who participated in FYE have shown a statistically significant and remarkable increase to their GPA scores as well as their mental health compared to those who did not participate once the effects of the program could be seen after a full semester of the program. Some future areas of interest for study regarding the program would be to further investigate other effects outside of GPA scores and mental health.

**Title: Fuel-Mass Optimization for Lunar Nuclear Reactor**

*Author(s): Morgan Rogers, Logan Jeffery, Dinyar Kadkhodaian*

*Primary URS Faculty Advisor: Dr. John Ford*

**Abstract:**

This project investigates the use of low enriched Uranium Tristructural-Isotropic (TRISO) fuels in potential lunar and martian nuclear reactors with the primary objective of minimizing overall reactor mass. These fuels were developed during the Gen IV "nuclear renaissance", and are presently the subject of great interest within the nuclear community. TRISO boasts promising results in burnup, longevity, heat resistance, and safety.



However, this team believes that the research in the use of TRISO for space applications needs to be further explored. In this study, present day core fuel assemblies and materials typically used in a high temperature gas small modular reactor are analyzed and adapted to the low gravity lunar environment. A TRISO particle is optimized to minimize the mass of the assembly, while maintaining a critical core, in conjunction with reflectors. The design goal of the project aims to cap the overall mass of the reactor at a maximum of 3500 kg, and maintain a power level of 10 kW for a minimum of 10 years. The project will conclude with a design for a low-enriched uranium TRISO fuel reactor core that minimizes the overall mass for a cost effective launch, and more importantly, a proliferation resistant and compact nuclear power system meant to support long-term lunar exploration.

**Title: GCode Path Reallocation for IDEX 3D Printing Systems**

*Author(s): Spencer Gautreaux*

*Primary URS Faculty Advisor: Dr. Dylan Shell, Ph.D.*

**Abstract:**

3D Printing is a growing field of interest, with research topics and commercial advancements in materials, processes, and systems. One of these advancements is the introduction of Independent Dual Extrusion (IDEX) Fused Deposition Modeling (FDM) printers in both the enterprise and consumer space. These systems utilize multiple hotends to create a singular part. However, these hotends presently cannot work collaboratively on the same part concurrently. Rather, in present systems, only one print head can operate on the part at a given time. The ability to use the print heads concurrently would bring about significant reduction in part print time. In this research we develop a model for this Concurrent IDEX printing. This model is based around exploiting the temporal and local properties inherent in the pre-existing GCode file. We utilize these features to find an efficient solution that an IDEX printer may use collaboratively. To test the algorithm, we utilize nearly 14,000 publicly available GCode files to explore the improvement, calculating the efficiency, the original print time divided by the new print time, for each file. This is done for both traditional IDEX formats, as well as two new theoretical models of IDEX printer. Finally we conclude with a discussion on further applications of this technology to other manufacturing formats.

**Title: Gender Differences in Partnership Dissolution Mechanisms**

*Author(s): Alexa Zotos*

*Primary URS Faculty Advisor: Dr. Rodrigo Velez*

**Abstract:**

This paper analyzes the effect that gender has in the process of executing arbitration protocols in partnership dissolution. The ongoing discussion concerning the differences in decisions men and women make based on incentives and room composition benefitted from this research because analyzing these differences resulted in concrete evidence confirming this clash exists between genders. There were 309 people surveyed identifying as either a man, woman, or non-binary with a singular two-part question. The questions identified their gender and what they would bid in a situation where an asset would be divided between two partners if one valued it more than the other. The participants were asked for their reasoning as to why they chose that amount in addition to what their bid would be. Our results confirm that gender has an effect on the execution of arbitration protocols in partnership dissolution, specifically in the splitting of assets. The average bids were calculated between the genders then tested to determine a p-value in their relationship to the null hypothesis. The calculated p-value for the bids between males and females shows the differences are statistically significant. The explanation regarding why a person chose to bid that amount was used in classifying the bidder's intentions and thoughts throughout the process which allowed males and females to be compared based on the most common explanations. This resulted in a percentage breakdown of males and females who did and did not exhibit these popular reasons, showing more of the differences between genders. Through the lens of gender inequality, this study documents a significant difference in the thought process of men and women in partnership dissolutions. This research contributes to the ongoing discussion regarding gender and how it affects a person's response to problems or opportunities.

**Title: Greatest Hits: A Visual Exploration of Strained Creativity**

*Author(s): Jordan Stawski*

*Primary URS Faculty Advisor: Prof. Samuel Woodfin*

**Abstract:**

Greatest Hits is a graphic novel about a group of 20-somethings sharing a room in the city trying to get by, while simultaneously attempting to create a following for their band. When given an opportunity to expand their popularity by playing their first big show, the band's frontwoman Hayley Adams makes a deal under questionable terms. The story focuses on Hayley as she battles with the pressure of an upcoming performance and her own shortcomings as an artist. The purpose of the creative artifact is to examine a different side of musicians that is not usually represented in media. Media representations about musicians tend to focus on larger than life figures and their rise and fall (and sometimes redemption) through a biographical or fantastical lens. These adaptations tend to commodify and objectify the subject they are portraying making the piece of media feel disingenuous to the subject's legacy. While few do have meaningful insight into the subject they are portraying, they still fall under the weight of tired clichés. This graphic novel tries to break the mold by offering a more intimate look into the inner turmoil a person might feel when faced with their own inadequacy, using the process of music creation as a vehicle to tell this story. Although the creative artifact deals with the subject of music it will also reach out to other creatives who will find solace with Hayley's insecurities and frustrations as an artist.

**Title: High Bandwidth Interposer Switch (HBI-S) Topology in modular SoC**

*Author(s): Sunyoung Park*

*Primary URS Faculty Advisor: Eun Jung Kim, Ph.D.*

*Co-URS Faculty Advisor: Pritam Majumder*

**Abstract:**

A slowdown of Moore's law leads to the concept of modular System on Chip, which is the idea of dividing a chip into small chiplets and interconnecting them with a large silicon interposer. It provides flexibility on having different topologies and routing algorithms. It is also advantageous in terms of power and efficiency compared to the traditional System on Chips. However, it has a deadlock issue when interconnecting the interposer with the chiplets. Remote Control is one of the techniques that can solve the deadlock problem. It places a buffer into the boundary routers with selective injection controls to avoid the deadlock from happening. Remote Control was proven efficient with a mesh topology. However, the interposer network experienced a bottleneck and limited the potential performance benefit of the RC technique. We came up with an High Bandwidth Interposer Switch (HBI-S) topology that improves the bisectional bandwidth compared to the mesh topology. It also significantly reduces the diameter of the interposer network. HBI-S topology showed higher saturation throughput compared to the mesh topology in the booksim simulation tested with various synthetic traffic patterns. Specifically, the bit-complement traffic pattern showed the highest increment in saturation throughput (about an increase of 111%). Tornado, shuffle, and asymmetric also showed an increase of over 90%. Therefore, building a dense interposer topology with high radix routers results in improved bisectional bandwidth that uplifts the RC performance by reducing the bottleneck.

**Title: Honey bee (*Apis mellifera*) macronutrient regulation: Nurse bee nutritional preferences for protein and lipid**

*Author(s): Cora Garcia*

*Primary URS Faculty Advisor: Juliana Rangel, Ph.D.*

**Abstract:**

Poor nutrition has been linked to declining honey bee (*Apis mellifera*) populations, as it makes bees more susceptible to pathogens and lowers their survival and productivity. Given the growing prevalence of urbanization and landscape fragmentation, resource availability has become a challenge to honey bees trying to acquire the resources necessary for adequate nutrition. In particular, honey bees are limited in the amount and type of macronutrients that they are able to collect from their surroundings, particularly pollen, which is the colony's main source of proteins and lipids. Not surprisingly, commercial pollen substitutes are widely used by beekeepers in times of pollen scarcity to support colony health. Here, we wanted to determine if there is a

target macronutrient intake for nurse bees by creating a range of artificial diets that differed in the macronutrient ratios of protein (P) and lipid (L). Through a series of choice and no-choice cage bioassays, we measured the daily amount of food consumed by nurse bees in each of five diet treatment groups varying in their protein to lipid ratio (P:L): 35:15, 30:20, 25:25, 20:30, 15:35, and unfed diet controls. In the no-choice test, nurse bees consumed the highest amount of the 30:20 P:L diet compared to bees given the other diets. For the choice test, bees regulated their diet intake to an average of 1.4 P:L., preferentially consuming more of the 30:20 diet. The significant changes in the observed ratio of the macronutrient consumption of pollen substitutes suggest that the role of lipids found in pollen and protein substitutes may be underestimated in the field of honey bee nutritional ecology.

**Title: How Children's Curiosity Predicts School Readiness: Examining the Moderation of Socioeconomic Status and Parenting Parenting**

*Author(s): Kathryn Gray*

*Primary URS Faculty Advisor: Rebecca J. Brooker, Ph.D.*

**Abstract:**

Curiosity is a natural way to gather more information about the world, making it directly related to learning. However, little research has examined the relation between children's curiosity and formal learning or the interaction of environmental factors. Understanding the nature of this association is important because boosting curiosity levels could be an efficient and economical way to increase children's school readiness. To address these gaps in the current literature, this study examined preschoolers' curiosity at age 3 as a predictor of academic readiness for entry to formal schooling at age 5. Furthermore, family socioeconomic status (SES) and parental behaviors were tested as moderators of the association between early curiosity and school readiness. The final sample for this work comprised 61 children. When children were 3 years old, family SES was self-reported by parents, and children's curiosity and parents' behaviors were observed during a laboratory episode. School readiness was assessed via parent report when children were 5 years old. Results showed that increased behavioral curiosity predicted decreased school readiness ( $\beta = -0.374$ ,  $SE = 0.144$ ,  $p = 0.009$ ) when accounting for SES. Behavioral curiosity may have been demonstrating a lack of knowledge or experience. High levels of SES predicted greater school readiness ( $\beta = 0.419$ ,  $SE = 0.135$ ,  $p = 0.002$ ) when behavioral curiosity was accounted for. Additionally, vocal curiosity did not predict school readiness. Thus, this study demonstrated how strong of a predictor SES is for school readiness and that the lack of opportunity for learning experiences may have an important role in predicting school readiness.

**Title: Hydrogels with Regional Mechanical Properties**

*Author(s): McKenzie Jones*

*Primary URS Faculty Advisor: Melissa A. Grunlan, Ph.D.*

**Abstract:**

Clinical treatments for intervertebral disc degeneration aim to relieve pain and stabilize the spine; however, lack in adequate replication of joint mechanics, donor site morbidity, and a low healing capability of the avascular tissue limits recovery. Studies have shown that hydrogels are a promising alternative than typical metal or ceramic implants as they have increased elasticity, tunable mechanical properties, and good biocompatibility. Double network hydrogels offer a biomaterial that has an ability for high strength from the electrostatic interactions between networks. Previous work has demonstrated that electrostatic and reversible, hydrophobic interactions in PAMPS/P(NIPAAm-co-AAm) double networks allows for a high modulus (~1 MPa) and high strength (~25 MPa) while maintaining desirable water content (~80%). To increase the modulus of this hydrogel without compromising the high strength or water content, work in the Grunlan Lab has focused on the incorporation of a cationic third network of PAPTAC – increasing the modulus to ~3 MPa, which is within the range of annulus fibrosus tissue. Because the IVD has two major regions with different mechanical properties, this study aims to create a single hydrogel that implements the regional differences. This was accomplished with a triple network hydrogel for one region, and fabrication of a gelatinous hydrogel for the other region. Connection of the two regions was accomplished with an electrostatic IPN and curing in a custom mold. Key material properties were evaluated (i.e. water content, modulus, and strength) and compared to the previously studied NIPAAm hydrogel and mechanical properties of a healthy IVD.

**Title: Impact of Brewer's Spent Grain on Soil Health and Productivity**

*Author(s): Noriki Miyanaka*

*Primary URS Faculty Advisor: Julie Howe, Ph. D.*

**Abstract:**

Demand for establishing a sustainable food system has increased in past decades. Average annual global production brewers' spent grain (BSG) is estimated to be ~39 million tons, and contains fibre, which include the abundant nutrients such as protein (19%-30%), hydrolysates of proteins, arabinoxylans and phenolic compounds. Application of raw BSG as a soil amendment has a potential to enhance soil health by supplementing organic materials and microbial activities and establish sustainable food production system. The main purpose of this project is to explore if application of BSG can enhance soil health, and influence production rate. In this research, soil health was defined as lower C:N ratio (abundant N), ability to replenish nitrogen, phosphorus, and potassium, and highly active microbial activity. Dry mass of total radish tissue including roots, stems and leaves was compared among different treatments. Elemental analysis was used to search C:N ratio and the N, P, and K content in soil and radish tissue. Beta glucosidase, N-acetylglutamate (NAG), and phosphatase enzyme test were used to determine microbial activity in soil. The result showed that the higher application rate of BSG and incorporation method has the higher yield, and soil health than lower and/or surface application. The presence of BSG acted as infiltration media and microbe activity support in nursery pots. This result suggests that BSG has potential to enhance soil health and potential yields in general food production.

**Title: Impact of COVID-19 on United States Milk Prices**

*Author(s): Shelby Lepley*

*Primary URS Faculty Advisor: Dr. Senarath Dharmasena*

**Abstract:**

The impacts of the novel coronavirus-2019, or SARS-CoV-2, have presented major implications to all industries across the United States. The agricultural field was not immune to these influences. Agricultural producers have witnessed significant changes in policy, management practices, and revenue as a result. Specifically, the dairy-cattle industry has experienced significant fluctuations in the price of its products. The objective of this research was to quantify the impact of the SARS-CoV-2 pandemic on the United States fluid milk prices and dairy producers. The data evaluated explains the changes in revenue that fluid milk producers have witnessed during the outbreak and response to the disease. The price analysis model in this research identified the monetary value that fluid milk producers for the United States have lost in revenue from January 2020 to November 2020.

**Title: Improvements for Store-Collect and Atomic Snapshot Objects under Continuous Churn**

*Author(s): Luis Pantin Mayaudon*

*Primary URS Faculty Advisor: Jenniffer L. Welch Ph.D.*

**Abstract:**

The field of distributed computing has given rise to many algorithms to share data among nodes in a network. This work focuses on the store-collect and the atomic snapshot objects in an asynchronous, crash-prone message-passing dynamic system with nodes continuously entering and leaving the system. We assume that the maximum number of nodes that enter, leave or crash during some time interval is proportional to the size of the system. A store-collect object is a distributed object that allows nodes to store data in the system in a variable that can be read by all nodes, but only modified by the node that stored it. This is achieved through two basic operations: the store operation, which stores information into the network, and collect, which collects a copy of all the information stored by every node in the network at the beginning of the time interval in which the operation is active. The Atomic Snapshot object is quite similar. It provides two operations, scan and update, that behave in a very similar fashion to the collect and store operations given by the store-collect object; however the Atomic Snapshot object must satisfy the linearizability condition, which means that it is always possible to arrange all the operations performed into an ordered sequence even if there are operations that occur simultaneously. This work improves upon the store-collect and Atomic Snapshot implementations

given in Attiya et al [SSS, 2020]. We developed a simple modification to the Atomic Snapshot implementation that allows nodes to delete information about nodes that leave the system. We also developed a method for quantifying the churn of a network subject to certain assumptions. This new method allows us to prove the correctness of the algorithm under less restrictive conditions than those found in the original proof of Attiya et al. Additionally, we developed an improved implementation of the Atomic Snapshot object based on a store-collect object that requires fewer messages to complete a scan or an update operation.

**Title: Integrin beta-1 Recruitment at Cell-matrix Adhesions in Aged Vascular Smooth Muscle Cells**

*Author(s): Frida Leon Olmedo*

*Primary URS Faculty Advisor: Andreea Trache, Ph.D.*

**Abstract:**

Arterial aging is characterized by reduced vessel contractility, arterial stiffening and endothelial dysfunction which are major predictors of cardiovascular diseases present in the elder population. At the level of vascular smooth muscle cells (VSMC), this corresponds to age-induced phenotypic changes from a contractile to a synthetic phenotype associated with decreased mechanosensitive response to external stimuli in these cells. This study is focused on analyzing the integrin-mediated role as a contributor to arterial vasomotor dysfunction through the VSMC response to extracellular matrix (ECM) components. To test the effect of matrix-functionalized substrate stiffness on integrin spatial distribution, VSMC isolated from soleus feed arteries of young and old Fisher 344 rats were plated on glass bottom cell culture dishes functionalized with matrix proteins (fibronectin and collagen I). Then, cells were stained for endogenous beta 1 integrin using mouse anti-beta-1-Alexa 488 direct-labeled antibody provided by Biolegend. Stained cells were imaged using total internal reflection fluorescence (TIRF) and/or confocal microscopy to analyze spatial distribution of beta 1 integrin at cell-matrix adhesions. Our results showed a significantly higher fluorescence intensity, indicating a greater amount of integrin beta 1 present at cell-matrix adhesions in young versus old VSMC in all conditions. The decrease of beta 1 integrin recruitment at cell-matrix adhesions in old cells shows a reduced cell adhesion to the matrix that correlates well with decreased contractility of aged VSMC.

**Title: Intelligent Room Reservation Systems**

*Author(s): Clara Stadler*

*Primary URS Faculty Advisor: Dr. Tracy Hammond*

*Co-URS Faculty Advisor: Dr. Paul Taele*

**Abstract:**

Study rooms provide a key resource for college students. However, many study spaces require reservations ahead of time to manage high demand; additionally, a reservation system serves to control the flow and population of a building to limit interaction during a global pandemic. However, existing solutions display a lack of user-friendliness that inhibits students' ability to schedule time in a room, effectively restricting them from this resource. This either occurs as a result of using cost-effective but inefficient tools, or as a result of poor design in a proprietary tool. To address these problems, I have developed a prototype of a system that brings the idea of the personal assistant to study room reservations. I gathered historical data from the Zachry Event Management System to analyze trends and I conducted surveys to identify the most important factors in scheduling for a student user. After developing my application and prototypes of existing solutions, I will conduct a user study to evaluate and compare my and existing methods. As the user study has not yet been conducted, I have no results to discuss at this time. However, I expect the user study to confirm conclusions from the preliminary surveys and establish what works and what does not in reservation system implementations.

**Title: Interception and near-surface soil moisture dynamics of woody vegetation in the Texas Post Oak Savanna**

*Author(s): Harrison Coker*

*Primary URS Faculty Advisor: Bradford P. Wilcox, Ph.D.*

**Abstract:**

There are few other regions that have been as significantly altered by woody plant encroachment as the southern great plains (SGP) of the United States. Rates of expansion of woody plants in this region are five- to sevenfold greater than in other regions of the U.S. (Barger et al. 2011). Although this transition is widely acknowledged in scientific and management circles, it has occurred so gradually that its extent is not universally appreciated. This study is located in the Post Oak Savanna, an ecoregion within the SGP located in east-central Texas. In this region, the transition from savanna to woody understory varies from area to area but most likely comes as a result of heavy overgrazing and fire suppression during the 20th century. I investigate the influence of yaupon holly (*Ilex vomitoria*) and other common woody species in the Texas A&M University Environment and Natural Resources Teaching Area (ENTRA) on the effects of rainfall interception and near-surface soil moisture dynamics. Because woody plants have a higher leaf-area index (LAI) and deeper rooting systems than savanna grasses, I propose woody encroached areas will maintain reduced soil water profiles as compared to areas that are open savanna. To explore this, interception rates are determined by measuring the volume of throughfall in at least 9 throughfall devices (TD) per canopy of shrub species and clusters, and then comparing these volumes to an unobstructed rain-gauge after each rain event. Continuous soil moisture is assessed with time-domain-reflectometry (TDR) sensors under 2 shrub clusters compared to 1 open savanna. Discrete measurements of soil water via neutron thermalization methodology occur at 30 locations selected to provide an array of vegetative covers and soil conditions. Present results suggest around 40% precipitation loss to interception in yaupon clusters and slightly reduced soil moisture profiles across sites. Therefore, further analysis of collected data will attempt to quantify the impact to the local water budget and explore the role of multiple-steady state theory in the POS as a condition of altered soil-moisture regimes.

**Title: Interconnected Financial Prediction using Time-Series and Network Data**

*Author(s): Maxwell Huffman*

*Primary URS Faculty Advisor: Yang Shen, Ph.D*

**Abstract:**

The digital technology age has created an unprecedented production and consumption of data. With this surge, data-analytics have become increasingly important in industries that can generate value based on predictive models: online retail, meteorology, transportation and navigation, social media, etc. This paper will focus on the financial industry because it contains years of available time-series data, a high correlation between prediction accuracy and generated value, and a high ceiling for creating a perfect prediction model that has yet to be reached. Historically, time-series forecasting has been used to predict how different companies' stock prices might behave in the future given how they have behaved in the past. However, focusing solely on sequential data for prediction is wasting the potential of interdependent information. Companies do not exist in a vacuum; they exist in markets that can heavily influence sets of entities at once. By grouping these entities and examining their relationships in the form of graph-based networks, interdependent data can be used in conjunction with sequential data to improve prediction accuracy. In this paper, Long Short-Term Memory (LSTM) deep neural networks will act as the foundation for which Graph Convolutional Neural networks (GCN) will be built atop to combine both sequential and relational embeddings in formulating a final prediction. Additionally, this paper will explore the benefits of rank-based loss functions and risk vs. volatility in portfolio stock selection, which is specific to the finance domain. To verify this hypothesis, closing stock price data from the NASDAQ during a five-year period was used.

**Title: Jokers and Thieves, A Graphic Novel**

*Author(s): Kyle Rively*

*Primary URS Faculty Advisor: Professor Samuel Woodfin*

**Abstract:**

This thesis breaks down the idea and process of an adaptation. It looks into the methods for adapting artistic materials from one medium to another and how my process changed to more I learned. Originally this was to reconcile my own influences but soon became an observation on how my views on storytelling evolved. In this thesis, I created a graphic novel adaption of Bob Dylan's all along the watchtower. I chose this work because I find it compelling from a thematic and visual standpoint but also because it has never been adapted before. Songs have been commonly adapted into visual form in the past through movies, music videos, and art pieces. I set myself apart from these mediums by adapting my work into a graphic novel. Graphic novels don't lend themselves to the fast-paced nature of music videos and require active participation, but they have benefits to them. They allow for tone setting and storytelling like music videos but don't have to adhere to a time structure. They also allow more in-depth storytelling with plot and character development, due to their longer form. At first, the research consisted of gathering resources to inspire my graphic novel. These were things like artist's works, other graphic novels, books, short stories, songs, and movies. This gave me an initial base to build the setting of the graphic novel. I changed my development process later in the project from research-based to instincts-based as the project continued. Showing how my views on storytelling evolved with the thesis. The final documents go into more detail with these steps and my growth as an artist as well as showing my final product.

**Title: Learning Styles and Techniques Used Among Undergraduates with Autism Spectrum Disorders**

*Author(s): Alena Flores*

*Primary URS Faculty Advisor: Marissa Cisneros, Ph.D*

**Abstract:**

As universities increase their student body, the autistic student cohort requires proper support from their faculty and peers. Individuals with Autism Spectrum Disorder have specific needs such as transference and social communicative issues that have to be considered to properly create community based support and services. Many previous studies showed that autistic students who had additional academic and emotional support presented higher graduation rates and GPAs, whereas students with generalized support, known as mainstreaming, were socially and emotionally depleted. For the past forty years, the learning styles of these students have been bolstered through the techniques of behavioral therapies. This study expects that through the integration of behavioral therapies, community creation, and specialized support, autistic individuals will feel more highly prepared for university and more likely to succeed. This paper presents the data of surveys and individual interviews of autistic students from Texas A&M University. Through the use of the Texas A&M University's bulk email system, the snowball method, and specific student outreach organizations, insight into this hidden population will be provided and analyzed through qualitative methodology. The results are expected to show a correlation between prior behavioral therapeutic intervention and satisfaction with university life and coursework. Additionally, the data will provide specifics on the resources that these students are currently using and how these programs could be improved upon from the students' perspective. As this study surveys the effects of proper academic support, peer support, and general awareness, autistic students will be less isolated from the academic community. By honing this data, additional research can be conducted to integrate this data into academic programs. This will allow for better support of students and diversify the academic field through accessibility.

**Title: Light Fidelity Tracking System**

*Author(s): Michael Sporkin, Ryan Quinn, Amanda Aboujaoude*

*Primary URS Faculty Advisor: Dr. Christi Madsen*

**Abstract:**

The proposed project will establish a baseline for a LiFi system through the implementation of a restorable stationary link to transmit an acceptable amount of power between a stationary base module and a mobile user module across the steradian application range. Since existing LiFi systems have limited mobility tracking, if

any, this project will improve the widespread applicability of LiFi communication and increase the versatility of system use. The laser diode-based system will implement a searching and tracking methodology that facilitates communication between a stationary base and a mobile user through the establishment of a representative link. Transmission of power from the laser diode to a photodetector on the opposing module will represent a link connection that could employ methods of optical communication data transfer. Upon movement of the mobile user in a given space, the link can be re-established. The system is being developed as an integrated product of four functional subsystems: an optical path that facilitates the representative connection; a searching subsystem that enables the base and mobile user to locate each other; a motor subsystem that aligns the modules to form the representative link; and a method of reading and recording output power to verify connection. The focus of research will be the tracking methodology, a significant challenge associated with the narrow-beam and directionally dependent laser diode responsible for communication. The objective output product will be a starting point for further research into faster and more efficient means of tracking for optical wireless communication systems.

**Title: Look Beyond the Veil: Coping with Anxiety and Trauma**

*Author(s): Jordyn Goodman*

*Primary URS Faculty Advisor: Samuel Woodfin*

**Abstract:**

My project is a 2D animated short film following the journey of a cherry blossom petal. She desperately wants to be a part of the forest goddess's flower veil just like all the other petals. It is the greatest honor of any petal's life. However, the petal soon becomes worried that she will be damaged as she is dragged across the forest floor. The other petals reassure her that she will be fine, but what will she do if her worst fear comes true? This short will illustrate how the petal's trauma and anxieties impact her life and how she deals with them as they take on a physical form. When faced with anxiety, psychologists will often tell you that your fears are an overreaction. A lot of the time they are right. However, if your worst fear comes true, all that advice shatters. Your overreactions now seem plausible, and it does not take long for those fears to consume your mind. It is important to let people know this can happen, and there is a path to recovery. For this reason, I will explore the use of a metaphor for anxiety and trauma on a person's wellbeing. In doing this, I want to normalize reactions to suffering and show an instance of how facing trauma can help heal from it. Trauma and anxiety take on many different forms, but they always intrude on life, making it hard just to live normally. Starting a conversation about this validates the daily struggles of people with mental illness.

**Title: Low-Cost Positron Emission Tomography (PET) Scanner Development**

*Author(s): Sarah Kusumo*

*Primary URS Faculty Advisor: Dr. Rupak Mahapatra*

**Abstract:**

Positron emission tomography (PET) is a tomographic, functional imaging modality that plays a prominent role in the healthcare industry. While medical imaging technologies are widely used to diagnose diseases and conditions, most are expensive to manufacture and maintain, as well as difficult to transport due to their large size and heavy weight. These characteristics therefore limit their accessibility to underdeveloped countries. To resolve the need for an affordable and portable medical imaging instrument, research was conducted to design and develop a PET scanner that would be significantly cheaper and smaller. This paper describes the process of researching and developing a PET scanner by way of its individual components, including but not limited to, photomultiplier tubes (PMTs), scintillator crystals, and electronic bases. PMTs were quantitatively analyzed then grouped by similar High Voltage values. Electronic bases were completely redesigned and manufactured to effectively reduce the size and cost of the overall PET scanner. A polishing method and a low-humidity storage shelter were researched and developed for the Cesium Iodide (CsI) scintillator crystals. Finally, an external shell was manufactured and a prototype is in the process of testing. Various methods of light-tightness were applied on the PMTs as well as the prototype, and they were examined qualitatively and quantitatively. Further research is being done to produce a working program to run the image reconstruction and generate the final image. A finished model will most likely be able to provide medical imaging accessibility to underdeveloped countries for a fraction of the costs at the expense of image resolution.



**Title: MODELLING OF A RADIATION THERAPY SYSTEM FOR BREAST AND LUNG CANCER THERAPY**

*Author(s): Ayesha Azimuddin, Insha Ayaz Shaikh*

*Primary URS Faculty Advisor: Othmane Bouhali, Ph.D*

*Co-URS Faculty Advisor: Shaheen Azim Dewji, Ph.D*

**Abstract:**

The success of a treatment planning system (TPS) for the treatment of cancer is highly dependent on the accuracy of the radiation administered and the dose delivered to the tumor volume. Based on the previous research, clinical beam accelerators are an imperative feature of the TPS which are widely used in radiation therapy facilities. Our project aims to conduct the reconstruction of the clinical beam accelerator, LINAC Varian Clinac 2300 C/D using comprehensive modeling method on a Monte Carlo Simulation software (TOPAS) and extract the radiation dose of the organs from simulations on phantoms to design a radiation therapy treatment plan. Monte-Carlo Simulation techniques are a precise tool to estimate the dose delivery to the target organs with the aid of sophisticated and reliable Geant4 toolkit. This research is vital to the understanding of the dose delivery to the cancerous tissues and the accuracy of a treatment planning system designed to act as an effective therapeutic weapon that implements a dosimetrically feasible strategy. The expected outcomes of this study are the validation of the LINAC with a previously modelled LINAC using the GATE simulation toolkit, determining the accuracy in the dose calculation of the heart which will contribute to the development of an effective treatment planning system that delivers the proper amount of dose to the cancerous tissues, limiting the exposure and consequent harm to the surrounding healthy tissues. This study will further be applied to the investigation of the correlation between the radiation dose imparted to the heart, the onset of cardiac toxicity and the occurrence of cardiovascular risks associated with the radiation therapy procedure.

**Title: Manipulation of Electrospinning Setup for Fabrication of Tunable Vascular Grafts**

*Author(s): Audrey Sheppard*

*Primary URS Faculty Advisor: Michael Moreno*

**Abstract:**

Over half a million individuals in the United States alone are affected by fatal cardiovascular diseases each year. A common treatment utilized to repair blockages in the arteries involves redirecting blood flow using autologous vessels, a process known as bypass grafting. However, the autologous vessels are commonly unavailable due to atherosclerosis, so research into tissue engineering nanofibrous graft scaffolds is being developed. Electrospinning has been shown to be an effective method for generating a biodegradable scaffold which shares the morphology and mechanical properties of the natural extra cellular matrix of a blood vessel. Manufacturing at the nanoscale allows for the manipulation of an environment where cells can proliferate. The electrospinning procedure forms nanofibers by ejecting a polymer solution from a syringe into an electric field onto a grounded collection apparatus. In order to produce a functional vascular tissue graft from electrospun biomaterials with tunable angle properties, the polymer blend, the collector design, as well as several other parameters must correlate to meet the appropriate constraints associated with electrospinning. After electrospinning a solution comprised of a polymer and solvent, scanning electron microscopy (SEM) and mechanical testing will be utilized to evaluate the nanofibrous sheets for arterial grafts.

**Title: Mercury and Selenium Concentrations in Alaskan Steller Sea Lions**

*Author(s): Kailey Wilkin*

*Primary URS Faculty Advisor: Todd M. O'Hara, Ph.D.*

*Co-URS Faculty Advisor: Robert Taylor, Ph.D.*

**Abstract:**

Mercury (Hg) is a neurotoxin that can cause health issues or even death. In Alaskan Steller sea lion (SSL) populations, Hg concentrations were observed to vary by region and time. These observations are of interest because SSLs, particularly the western population segments, are classified as an endangered species. This study intends to investigate what may be causing regional Hg differences and if there are other elemental correlations. Blood and hair samples were obtained from SSL pups. The hair samples were formed while the pup was in utero, so concentrations are reflective of the mother's diet. To achieve the goals of this study, the

blood and hair samples will be digested in order to homogenize the samples, then analysis will be conducted using inductively coupled plasma mass spectroscopy (ICP-MS) and inductively coupled plasma optical emission spectroscopy (ICP-OES), methods that are used to determine concentrations of elements in solution. These analytical methods were chosen because they may be used with different sample types, and they are capable of detecting a variety of elements. These techniques will allow other elemental trends, in addition to the previously observed levels of mercury and selenium, to be observed. In addition, previous literature was reviewed, and results from the ICP-MS and ICP-OES analyses will be compared with published data. At this time, data collection is still ongoing as samples continue to be processed. Some things to consider are documented health effects that correspond with measured Hg values. These will provide some insight into damage to the overall health of the SSL population and guide efforts to aid species protection and recovery.

**Title: Mindwrack: Radicalization, Class Warfare, and Technologically-Catalyzed Upheaval from a Fantasy Perspective**

*Author(s): Gabriel Zolton*

*Primary URS Faculty Advisor: Lowell Mick White, Ph.D.*

**Abstract:**

In this project, I explore the question, “What drives people to use deadly force against oppression?” in the context of a fantasy world. I review a variety of works and research topics pertaining to the radicalization of individuals, instances of class warfare, factors that lead to revolutions, and historical conflicts characterized or made possible by the onset of new technology. Such topics pervade most of recorded history, remain at the forefront of our thoughts as new changes take hold. Though revolutions, societal discontent, and individual rebellions are not uncommon occurrences in fantasy novels, I take research on realistic manifestations of responses to an unfair society and incorporate it into a fantasy setting of my own design, specifically exploring inter-class tensions exacerbated by massively disparate power dynamics. By exploring and building off of topics such as the radicalization process; the differing outcomes in cases of individual, “Lone wolf” radicalization and those of group radicalization; the tensions between groups of varying power dynamics either real or perceived; and the varying speeds of adoption, immediate impacts, and long term impacts of technology in technological turning points throughout history—for instance, how the clash of updated weaponry and dated tactics made World War I have such heavy casualties—I will synthesize historically-relevant findings into a fantasy narrative that explores, primarily, three main individuals who, through their different experiences with the power system currently in place, find themselves undergoing different degrees of radicalization from different sources—in some cases, finding that new technology enables them to accomplish feats never before considered possible in the fantasy world. The outcome for this project is a creative artifact in the form of a novel; though the full novel will not likely be finished or in a post-editing state by the completion of this project, enough will be completed and included as a creative artifact at the end of this thesis in order to contextualize and give examples of some of the ways in which this research concretely appears within the narrative.

**Title: Model-based Decision Planning Using a Model-free Agent**

*Author(s): Josiah Coad*

*Primary URS Faculty Advisor: Guni Sharon*

**Abstract:**

Reinforcement learning is a rapidly developing field, however current policies often are noisy and result in unnecessary control expenditure because they only “plan” one step ahead. Our work generalizes the one-step policy to n-step and then applies smoothing criteria to the n-step action plan to result in a smoother overall trajectory. This approach has applications in robotics where smoothness of the trajectory is a concern as well as interpretability of the control plan. Some examples include self-driving cars and large robotic arms for manufacturing. Our work builds on recent work in reinforcement learning (both model-free and model-based) and classical motion planning techniques.

**Title: Moral Luck: A Summary**

*Author(s): Kenneth Siler*

*Primary URS Faculty Advisor: Dr. Linda Radzik*

**Abstract:**

In this paper I discuss the paradoxical nature of moral luck by mainly focusing on the claims made by two significant authors on the subject. Thomas Nagel provides a response to Williams' initial claims pertaining to moral luck, proving that moral luck is not, in fact, an oxymoron as Williams once believed it to be. He relies on ideas about the control principle and how we form our moral judgements. Susan Hurley takes a slightly different approach in considering the question of moral luck. She takes the inverse of luck, which can also be called responsibility, and goes on to craft and analyze different perspectives from a contextual and theoretical account. In this paper I aim to provide a clear explanation of the ideas both these philosophers present, as well as giving my own explanation as to why moral luck is not something that necessarily should be avoided.

**Title: Multi-modal Data Fusion and Machine Learning for Deciphering Protein-Protein Interaction**

*Author(s): Arghamitra Talukder*

*Primary URS Faculty Advisor: Dr. Yang Shen, Assistant Professor, Electrical & Computer Engineering*

**Abstract:**

The structural interactions between proteins can be considered as the core of cellular processes and the partnership provides a lot of answers to decode Molecular Biology. Though from time to time various experimental and computational methods have been applied to predict identities of protein-protein interactions (PPI), a knowledge gap is there to understand their interactions in 3-dimensional (3D) space. This research project aims to use existing protein data in multiple modalities and advanced machine learning techniques to develop an algorithm for better prediction of PPI in 3D. The algorithm will use multimodal data fusion and machine learning to construct predictive models. Using the sequence of proteins and the available interaction structures, this project aims to answer if given two proteins interact, how they interact, and their distance distributions between two residues. The success metric of the algorithm will be the accuracy of the testing and validation group of data; it also aims to cover a broad range of scope making it more versatile.

**Title: Nautical Archaeology Digital Library**

*Author(s): Muhammad Nauman*

*Primary URS Faculty Advisor: Richard Furuta, Ph.D.*

**Abstract:**

A problem that exists in The Nautical Archaeology Digital Library at the Texas A&M University is that there is no database of images with good filtering, tagging, and cropping capabilities. The goal is to research and evaluate different web-based system accessible by everyone that will allow them to upload and search images. It will allow the person uploading to assign metadata to that image/painting and also allow them to crop certain parts (the original will be preserved) of images to highlight and assign more metadata to that subpart(s). This system will also prompt the person uploading to categorize the ship or image so that the filtering/searching capability can be made. Furthermore, this system will allow the admins to password-protect specific images, if needed. Researching how this system can be implemented and how nautical archaeologists categorize ships will be very beneficial to the Nautical Archaeology committee. This system will also preserve images, with data, and provide a central place for images. Then, this system will be added to the [nadi.tamu.edu](http://nadi.tamu.edu) website. This research is significant because it will help in building a central database for conservation of nautical archaeology evidence and items in one central database with metadata assigned to it. Another problem with the Nautical Archaeology Digital Library is that the website is hosted on physical servers at Texas A&M University. These servers can be unreliable at times and these servers will soon be outdated. The goal is to research and evaluate different virtual servers based on accessibility, usability, and pricing where the Nautical Archaeology Digital Library can find a new home.

**Title: Nursing Virtual Reality Training Program for SBIRT (Screening, Brief Intervention, and Referral to Treatment)**

*Author(s): Brendan Hutchins, Andrea Ballesteros*

*Primary URS Faculty Advisor: Jinsil Hwaryoung Seo, Ph.D.*

*Co-URS Faculty Advisor: Caleb Kicklighter*

**Abstract:**

Does a virtual reality training simulator enhance a nurse's ability to learn basic screening, brief intervention, and referral to treatment (SBIRT) skills better than traditional training programs? Due to SBIRT's universal screening process, it was clear that the most beneficial training application would conduct role playing simulations where practitioners could be immersed and able to put their skills to the test. The access provided by the virtual reality application not only addressed the limited opportunities students have to practice screening and brief intervention skills, but also provides a practical solution to do so with physical distancing measures in place. As today's world faces the need to place strict social distancing measures, new avenues like virtual reality are opening doors to practice a new way of interaction and learning. Past studies have researched whether standard online video training modules, in-person instruction, role-plays and optional patient simulations have a sufficient effect in student practitioner's overall performance; however, simulated training in virtual reality was not considered as part of the equation. Our research will be focused on the efficacy of our virtual reality training simulator by finding the amount of exposure necessary before significant changes are seen in a practitioner's SBIRT knowledge, skills and confidence compared to other traditional programs. Utilizing text-to-speech solutions, microphone input, and character lip-sync, we are able to create a realistic environment that nurses can use to practice and test their SBIRT skills. With a variety of scenarios, voices, and characters, the application "Nursing Virtual Reality SBIRT Training Program," will provide an effective method for simulated environments.

**Title: On Modern Offloading Methods: A Critical Analysis**

*Author(s): Scott Carrión*

*Primary URS Faculty Advisor: Dr. Jeff Huang*

**Abstract:**

The very concept of offloading computationally complex routines to a graphics processing unit for general-purpose computing is a problem left wide open to the academic community, both in terms of application as well as implementation, with several different and popular interfaces exploding into popularity within the last twenty years. These intricate, advanced interfaces are all designed with specific goals in mind, as with any project. However, as these interfaces must accommodate general purpose computing for graphical processing units, and, given that no interface, or its implementation is perfect, within each interface there must exist strengths as well as weaknesses in terms of its practical implementation facility, its correctness in the general case, and its performance in the general case. As those who framed and derived these technologies are all but obligated to support and defend their project unreservedly, there exists no critical, impartial analysis of contemporary offloading parallelization methods. This study accomplishes and presents such an analysis by means of parallelizing well-known algorithms in C/C++ using three of the most popular interfaces, (OpenMP, CUDA, and OpenACC) discussing their practical implementation facility generally, and finally empirically assessing the general correctness and performance of the parallelized algorithm for each benchmark. For completeness, the empirical analysis contains both a comparison to the unparallelized algorithms, as well as the other parallelized implementations of the algorithms. From these two-pronged analyses, overall evaluations, and detailed enumerations of, the aforementioned strengths and weaknesses of each interface are derived and presented.

**Title: On the Relationship Between Communion and Freedom: A Philosophical Analysis of Popular Film**

*Author(s): Brandon Smith*

*Primary URS Faculty Advisor: Daniel Conway, Ph.D.*

**Abstract:**

In this thesis, I will demonstrate the essentiality of communion relationships in the attainment of positive freedom. To do so, I will utilize the popular films *Dead Poets Society* (1989) and *Good Will Hunting* (1997) as

case studies, in which I will conduct a comparative and philosophical analysis of the films. Specifically, I will analyze these films in light of Martin Buber's seminal work *I and Thou* (1923), in which he categorizes human social existence into two modes: I-It relationships and I-You relationships. Whereas an I-It relationship is one of objectification, an I-You relationship is one of communion. Briefly, objectification is a failure at acknowledging the subjectivity of the other. Communion, on the other hand, is a state of intersubjectivity in which both persons reciprocally acknowledge the other's subjectivity. Principally, I will propose that *Dead Poets Society* illustrates a failed attempt by John Keating at begetting positive freedom in his student Neil Perry, whereas *Good Will Hunting* displays a successful attempt between Sean Maguire and Will Hunting. The key reason for the different results of the films is that Will Hunting and Sean Maguire successfully enter into an I-You relationship, thus entering into communion, whereas Neil and Keating fail to do so. Namely, Keating fails to enter wholeheartedly into the relationship, choosing instead to hold part of himself back. As a result, Keating inhibits communion from ever occurring, thereby disrupting Neil's attainment of freedom. Moreover, I will delineate the communion process (or the failure thereof in the case of *Dead Poets Society*) as three stages: presentation, communion, and post-communion. Notably, the nature of the failure or success at communion lies in Keating's and Sean's respective approaches at encountering Neil and Will, which proves critical for the young men's development. Briefly, an encounter is, for Buber, a simultaneous movement of complete self-offering to and reception of the other. Therefore, I will show that where Keating fails to offer himself totally to Neil, thereby inhibiting his reception of Neil, Sean succeeds in his relationship with Will. As a result, Neil's life tragically ends in alienation, whereas Will's begins anew in freedom. Ultimately, I will demonstrate from my analysis both that the communion relationship is necessary in order to attain positive freedom as well as the value of film as a source of philosophical reflection and medium for self-discovery.

**Title: PROTOCOL OPTIMIZATION OF QPCR FOR ANALYSIS OF EFFECTS OF ANTIBIOTICS ON MULTIDRUG-RESISTANT SALMONELLA POPULATIONS IN EXPERIMENTALLY CHALLENGED SWINE**

*Author(s): Megan Babowicz*

*Primary URS Faculty Advisor: Keri N. Norman, Ph.D.*

**Abstract:**

Antibiotic resistance is a food safety concern. Antibiotics may be given to livestock for many reasons and this treatment promotes the development of strains which are less susceptible to the antibiotics. If these bacteria survive food production and manage to infect a consumer at the end of food production this can result in a threat to the consumer's health and safety as the infection has fewer treatment options. My project is a continuation of a previous project wherein swine were challenged with pan-susceptible and multi-drug resistant (MDR) strains of *Salmonella*. The bacteria were given several days to replicate then the swine were placed on a 14-day antibiotic course in the feed. I am analyzing stool samples collected on key days in order to examine the effects over time of the antibiotics on the *Salmonella* populations. I am analyzing the presence of *qnrB19*, *bla<sub>shv12</sub>*, and *invA* genes within the stool samples collected. These genes confer decreased susceptibility to quinolones, increased resistance to extended spectrum  $\beta$ -lactamases, and allow for invasion of the target cell respectively (the *invA* genes are universally present in *Salmonella* and serve as a marker for the pan-susceptible strains). I am analyzing the presence of these genes within the stool samples via QPCR which amplifies the present genetic material. I can then determine how many bacteria carrying these genes were present within the sample to see how the MDR strains were affected over the course of the trial. I am currently focused on protocol optimization of the three experiments, with the new *qnrBMBab* primers and associated probe showing the most promise in producing a viable standard curve. *Bla<sub>shv12</sub>* has shown issues with specificity and *invA* has shown replication of the desired genetic material but has had issues in detection. These issues will be addressed with continuing adjustment of settings and the potential replacement of materials for both. This protocol optimization not only allows for future streamlining of my own research with these sequences but the addition of the sequences to the public knowledge for testing these genes.

**Title: Pattern-Based FPGA Routing**

*Author(s): Brandon Gathright*

*Primary URS Faculty Advisor: Jian Hu*

**Abstract:**

The complicated process of determining the shortest and most efficient connections between various logic blocks on an FPGA board is called routing. The limited amount of switch boxes, channels, and other routing resources that can be utilized increases the complexity and computation time of finding these paths. More common than not, initial routing computation for very large circuits yields unroutable results caused by highly congested areas of the design. As a result, most routing solutions lead to slow implementations caused by long wirelengths that attempt to avoid these highly congested areas. However, due to a trending increase in demand for highly regular FPGA designs, such as systolic array-based neural networks, this computation time can be reduced significantly. This paper focuses on exploiting FPGA design regularity to reduce routing computation time by repeating previously determined paths for identical placements. To achieve almost guaranteed routability and excellent design performance, the PathFinder routing algorithm is used to compute the routing of each different design pattern. These patterns will be determined during FPGA synthesis, where the design will be classified into various patterns based on logical similarity. Further computation time is reduced by skipping the routing calculation for each placement of the same pattern. The routing solution for the first instance of each pattern will be copied across all similar instances. Research is still ongoing so results have not been collected, however a 5-10% minimum reduction in routing computation time can likely be expected.

**Title: Performing in The Pandemic**

*Author(s): Olivia Parker*

*Primary URS Faculty Advisor: James Ball III, Ph.D*

**Abstract:**

How has COVID-19 impacted audience and performer relationships in Live Art and performance? My primary methodology is performance as research: my creative work itself provides my data regarding the nature of mediated experience in 2020. I am drawing on my experiences, personal art made since March 13th, 2020, and the work of others working at the intersection of theatre and technology, to create a multimedia performance. Audience members can attend this one-on-one performance or choose to be part of the livestream audience. A recording will be available after performances conclude. COVID-19 has significantly impacted my studies and artistic practice. Since March 13th, 2020, everything I make is suddenly mediated by screens. My independent study--a live, interactive, stage musical--was postponed, recast virtually, and will be rehearsed and performed in a hybrid format. I am president of an honors theatre organization that performed a Virtual Student New Works Festival. This Fall, I collaborated with other students to create a dance piece about relationships and mediation. I've learned firsthand that technology is essential for the collaborative process. Normal audience to performer interactions have shifted or become impossible. Inherent and occasionally intentional alienation effects distance audiences in new ways. Collaborative relationships function differently when mediated by a screen. During the COVID-19 pandemic, technology is changing what it means to be 'Live.'. Screens function as the 4th wall, but do not always support generative feedback loops between audiences and performers, and unforeseen complications can cause 'glitches.' As we live, learn, gather, and create online, it's key to investigate how technology mediates collaborative relationships.

**Title: Personalizing Oral Health Care: The Future of Dentistry on a Chip**

*Author(s): Anna Trujillo, Diane Tang, Sophia Jang, Sana Anwar*

*Primary URS Faculty Advisor: Dr. Faizam Kabani, PhD, MBA, MHA, RDH, FAADH*

*Co-URS Faculty Advisor: Maureen D. Brown, RDH, MS-HIED*

*Co-URS Faculty Advisor: Eric Fox, RDH, MS*

**Abstract:**

Personalized dentistry is advancing, and the tooth-on-a-chip (TOC) device has the potential to aid clinicians in making informed decisions about patient care based on their genetic makeup. The use of genomics to practice personalized medicine demonstrates a transition from presenting the gold standard in care to targeted

treatments via a deeper understanding of disease and molecular processes. Increased use of personalized data through biotechnological advancements may enhance efficient evidence-based practices. One of the first successful micro-fluidic devices, Organ-on-a-chip (OOC) enabled researchers to study human physiology as it assisted in the progression of personalized medicine and dentistry leading to the creation of TOC. Standard dental procedures involving restorative biomaterials such as adhesives, acid etches, and composite resins degrade over time and may lack biocompatibility depending on the patient's oral microbiome. TOC provides an in-depth view on the arrangement of the tooth organ, improves the understanding of the inner processes of dental cells in their natural environment, and assists in understanding their reactions to biomaterials.

**Title: Plant to Plant Communication Affected by Lipoxygenase Genes**

Author(s): Katie Toomey

Primary URS Faculty Advisor: Mikhailo V. Kolomiets, Ph.D.

**Abstract:**

Volatile organic compounds (VOCs) enable plant communication. Herbivore-induced plant volatiles (HIPVs) allow uninfested plants near infested plants to pre-emptively raise their defenses to impending insect attack. Plant response to HIPVs involves the synthesis of various lipoxygenase (LOX)-derived oxylipins, including the insect defense phytohormone, jasmonic acid (JA). Importantly, LOXs can collectively synthesize a diverse array of oxylipins, however, whether any of these other oxylipins are involved in insect defense or HIPV response remain largely unknown. Green leaf volatiles (GLVs) are a major group of oxylipin HIPVs and are known to induce the expression of specific LOXs. Several maize knockout mutant lines disrupted in specific LOX genes were chosen because their expression is GLV-inducible. Therefore, these mutants are hypothesized to lack certain defense metabolite responses to HIPVs. By selectively testing metabolite responses of *lox* mutants to HIPVs, we aim to identify the role of LOX4, LOX5, and LOX10 in the response of *Zea mays* to HIPVs and the specific signaling metabolites they generate. We performed experiments in which fall armyworm (FAW) were allowed to feed on wild-type maize seedlings, termed "emitters", resulting in the production of HIPVs. The *lox* mutants exposed to emitter volatiles are termed "receivers". We collected tissue from the receiver plants and will quantify a large number of oxylipins and several major defense phytohormones via LC-MS/MS. This analysis will identify perturbations in accumulation of several different oxylipins across the different *lox* mutants and will identify the individual LOX isoforms involved in their induction or synthesis.

**Title: Polyphosphate Signaling in *Dictyostelium discoideum* Hints at Potential Therapeutics for Tuberculosis**

Author(s): Ryan Rahman

Primary URS Faculty Advisor: Richard H. Gomer, Ph.D.

**Abstract:**

Tuberculosis is one of the leading causes of death by any single infectious agent worldwide. The bacterium that causes tuberculosis, *Mycobacterium tuberculosis* (*Mtb*), has evolved mechanisms to bypass host defenses, even when engulfed by macrophages into phagosomes. Phagosomes normally fuse with lysosomes, and this kills ingested bacteria, but *Mtb* prevents this fusion and proliferates in macrophage phagosomes. Understanding how *Mtb* prevents phagosome-lysosome fusion and thus the killing of ingested bacteria may enable us to develop therapeutics for tuberculosis. *Dictyostelium discoideum* is a eukaryotic microbe that feeds on bacteria by phagocytosis, like macrophages. We found that chains of phosphates called polyphosphate act as an extracellular signal that prevents phagosome-lysosome fusion, and causes *Dictyostelium* cells and human macrophages to retain ingested bacteria alive in the phagosome, analogous to *Mtb* infection. *Escherichia coli* K-12 do not accumulate detectable levels of extracellular polyphosphate and have poor survival after phagocytosis by *Dictyostelium* or macrophages. In contrast, *Mycobacterium smegmatis* and *Mtb* accumulate detectable levels of extracellular polyphosphate, and have much better survival after phagocytosis by *Dictyostelium* or macrophages. We developed an assay to use the power of *Dictyostelium* genetics to elucidate the signal transduction pathway used by polyphosphate to prevent the killing of ingested bacteria. After allowing *Dictyostelium* cells to ingest bacteria, the number of live ingested bacteria in the presence or absence of polyphosphate are counted immediately after ingestion, and at 48 hours. Wild-type *Dictyostelium* and 21 signal transduction pathway mutants responded to polyphosphate by the decreased killing of ingested bacteria. Mutants lacking the polyphosphate receptor are insensitive to polyphosphate and kill bacteria even in the presence of polyphosphate. We found three additional mutants

that are insensitive to polyphosphate signaling, suggesting that the absent proteins in these mutants are required for *Dictyostelium* to sense polyphosphate. Pharmacological inhibition of any of the human homologs of these proteins might prevent macrophages from sensing the polyphosphate signal from *Mtb*, and thus allow them to kill engulfed *Mtb*.

**Title: Private, Distributed, Untrusting Combinatorial Filtering**

*Author(s): Will Curran*

*Primary URS Faculty Advisor: Dylan Shell, Ph.D.*

**Abstract:**

We consider the scenario where two or more independent agents would like to filter their combined sensor data without disclosing private data to one another. We introduce a secure multiparty primitive which allows a number of parties to feed their time-indexed sensor data through a combinatorial filter while preserving individuals' privacy. Then, we go on to prove that the primitive is secure under the semi-honest adversary model, and we discuss guidelines for shielding the filter's output from reverse-engineering. Such a primitive enables collaboration amongst mutually distrusting robots who wish to learn more about their environment. Even systems of more trusting robots may make use of this primitive to make their operations more robust against attacks on individuals.

**Title: Progress toward the Absolute Asymmetric Synthesis of Homochiral Peptides**

*Author(s): Faris Zaibag*

*Primary URS Faculty Advisor: Daniel Singleton, Ph.D.*

**Abstract:**

Nearly all molecules in the universe inherently have a “handedness” property known as chirality due to their 3-Dimensional structure. Two molecules with identical chemical compositions can be “L-” and “D-” mirror images of each other, which behave differently in a living system. The exclusive synthesis and use of L-amino acids by cellular machinery is a ubiquitous biological feature of nearly all organisms. This indicates that homochiral L-amino acids may have existed before the appearance of life. Understanding how this homochirality originated is a key component of any theory regarding the origin of life. However, this is a non-trivial problem. In the absence of a chiral catalyst to promote the formation of a specific mirror image, most chemical reactions generate an equal mix of the two enantiomers. Peptides produced from such racemic solutions would be prohibitively unlikely to afford the required homochiral peptides. It has at times been suggested that this step, the generation of homochirality, is an insurmountable problem. However, a number of chemical processes have been identified that can generate non-racemic products from achiral reactants. The Soai reaction is particularly notable because of its ability to produce homochirality intrinsically, via asymmetric autocatalysis. It produces an enantiomeric excess from achiral starting materials, and thus can be utilized to generate chirality. The Soai reaction itself could not plausibly happen on a primordial earth, and its product is not an amino acid, but it is an example of a chemical reaction which could have led to the homochirality required by life. Toward that end, my research has focused on the conversion of the Soai product into homochiral polypeptides of the L-amino acid valine.

**Title: Pyrolysis and Oxidation of Gas Turbine Lubrication Oils**

*Author(s): Noble Gutierrez*

*Primary URS Faculty Advisor: Eric Petersen, Ph.D.*

**Abstract:**

Many problems are caused by coking within engines – namely in gas turbine engines with their extreme operating conditions. Coking is a type of deposit formation and can interfere with reliable fluid flow and a machine's mechanical movements, increase wear rates, decrease oil flow rates, damage mechanical seals, reduce heat transfer, and result in other issues as well. Temperature, hot-surface-contact, and oxidation with lubrication oils are crucial factors in deposit formations. In order to observe and examine the factors that lead to certain amounts of coke, an experimental coking rig is being constructed. The rig consists of tubing, a pump, two oil reservoirs, a test section tube, thermocouples, pressure transducers, medium pressure valves, high



temperature valves, adapters, a cooling element, and a flowmeter. These components will allow for the flow oils through the test section to be taken out to observe levels of coking under certain conditions. Physical samples from the test section tubing will be taken and measured for thickness of the coke layers. Pressure drops in the areas where coking is produced will be examined. Pressure measurements via voltage output through pressure sensors can be graphed and analyzed with software. Understanding precisely the factors that lead to deposit formation stemming from oil degradation can help engines last longer and save large amounts of money in replacements and repairs. Further investigation will help with efficient engine development and improvements in various industries with regards to oil flow and use.

**Title: Radial Velocity Properties of CEMP(Carbon Enhanced Metal Poor)-r/s Stars**

*Author(s): Jared Cathey*

*Primary URS Faculty Advisor: Jennifer Marshall*

**Abstract:**

A large fraction of low metallicity stars show large enhancements in carbon. These stars are known as Carbon Enhanced Metal Poor stars (CEMP stars). A subgroup of these show enhancements of neutron-capture elements through both the slow (s) and rapid (r) neutron-capture processes, these stars are called CEMP-r/s stars. How these stars get their peculiar abundance patterns is currently unknown, but in similar types of stars it has been shown that mass transfer in binary systems plays a significant role in their abundance patterns. If binaries do play a significant role in the enhancement of CEMP-r/s stars, I expect to find a large fraction of the stars I am studying to be in binary systems. The goal of this project is to better understand what role binaries have in the formation and enrichment of CEMP-r/s stars. At this point in the project, I have been analyzing optical spectra obtained over the past two years for a sample of CEMP-r/s stars. Using the astronomical image reduction software IRAF I have been extracting radial velocity data to combine with literature data and will use this to identify possible binary systems. For these potential binary systems, I will determine orbital properties of the system and conduct further analysis on properties such as abundances. These tasks will be done with the radiative transfer code MOOG and python tools.

**Title: Raman-Spectroscopy Based Diagnostics of Lyme Disease in Mouse and Human Blood**

*Author(s): Rohini Morey*

*Primary URS Faculty Advisor: Dr. Dmitry Kurouski*

*Co-URS Faculty Advisor: Dr. Artem Rogovskyy*

*Co-URS Faculty Advisor: Rohini Morey*

**Abstract:**

Lyme Disease (LD) is reportedly the most widespread vector-borne disease in the continental US. The causative LD agent is the spirochetal bacterium, *Borrelia burgdorferi* (*Bb*), which is spread through *Ixodes* ticks. When untreated, early non-specific symptoms such as fever, chills, and rashes can give way to more extreme conditions such as dermatitis, arthritis, facial palsy (i.e., partial facial paralysis), and severe neurological disorder (e.g., meningitis). LD is often misdiagnosed due to the early flu-like symptoms and poor sensitivity of the only validated two-tiered serological testing. This thesis compiles the results of two studies, which have examined the possibility of using Raman Spectroscopy (RS) as a diagnostic tool of LD. RS is a method that uses the excitation of particles to higher vibrational and rotational states to distinguish between different chemical structures. The first study involved infecting mice with two wild-type *Bb* strains (B31, 297) and one B31-derived mutant ( $\Delta$ visE), and using a home-built confocal Raman microscope to acquire spectra of blood sampled from the mice prior to and after *Bb* infection. The Partial Least Squares- Discriminant analysis of the spectra resulted in detection of *Bb* mouse infection with 86% accuracy for 297, and with 89% accuracy for *Bb* B31 and  $\Delta$ visE. The second study involved testing of human blood sampled from LD-confirmed, LD-probable, and LD-negative (control) patients. The results showed that the True Positive Rate was 90%.

**Title: Reactive Attitudes Borne Towards the Self**

*Author(s): Alexandra Campbell*

*Primary URS Faculty Advisor: Dr. Nathan Howard*

**Abstract:**

As an individual defining my moral compass, I became increasingly familiar with the idea of people explaining morality as it pertains to others, not as it pertains to themselves. Similarly, moral philosophy tends to approach moral emotions from the third-person point of view. This paper will take these same concepts of moral philosophy and apply them to the first-person perspective. The first chapter will examine reactive attitudes directed to the self. In other words, I will argue that I can hold reactive attitudes towards myself. From there, chapter two will look at the relationship between reactive attitudes and the conscience. I will defend the idea that the exercise of conscience involves reactive attitudes. Chapter three will analyze the morality of actions directed towards oneself. I will argue that it is possible to wrong myself through my actions. The final chapter will piece together each of the prior chapters to answer the question: is self-castigation ever fitting? I will explain how it is sometimes appropriate to sanction myself for my actions that wrong myself. The overarching paper will illuminate reactive attitudes towards the self, the relation between the conscience and reactive attitudes, the ability of a person to wrong themselves, and the connection of these ideas in sanctioning the self. The paper advances discussion of the attitudes of pride or guilt by adopting an introspective point of view. This paper gestures towards questions about the appropriateness of sanctioning the self and about the concept of self-release.

**Title: Real-Time Signal-to-Noise Optimization of Bio-Impedance Signal for Cuffless Blood Pressure Monitoring**

*Author(s): Bryant Passage*

*Primary URS Faculty Advisor: Roozbeh Jafari, Ph.D.*

**Abstract:**

Blood pressure (BP) monitoring is essential as high BP is a major risk related to cardiovascular disorders (CVD). Continuous BP monitoring provides significant advantages in predicting future cardiovascular disease over traditional BP measurement methods. Traditional BP measurement methods are based on an inflatable cuff which is bulky, invasive, and inconvenient for true continuous monitoring. Within the method of continuous BP monitoring, the measurement of pulse transit time (PTT) is essential to estimating BP over time. PTT is the time taken for a pressure pulse to travel between two points in an arterial vessel, which is correlated with BP. This is mainly accomplished through bio-impedance sensors that monitor the arterial pressure pulse from the blood volume changes at the sensor site which result in impedance changes that can be read through the bio-impedance sensors. These small impedance changes from the body, along with a carrier signal from current injected into the body, generate amplitude modulated signals that can be digitally processed in real-time to produce bio-impedance signals. The bio-impedance sensors can be placed on the wrist, in-line with the radial and ulnar arteries and can be incorporated into a wrist-worn device such as a smartwatch to provide a truly continuous BP monitoring device. However, the quality of the bio-impedance signal from each sensor is significant to the accuracy of PTT and the estimation of BP. For the device to be wearable for any user, placement of sensors over the arteries and contact quality between the electrodes and skin may not be optimal. In this research, we present an automatic gain control (AGC) circuit as a method of increasing the signal-to-noise ratio of bio-impedance signals for the cuffless BP monitoring device. AGC senses the skin-impedance and determines the need to increase or decrease current injection through the body to ensure injection of maximum current to maximize the signal-to-noise ratio while avoiding saturation of the current injection module. In this research, data was collected through a custom calibration board that models skin-impedance and with participants using our custom low-noise bio-impedance sensing hardware. AGC efficiently increases signal-to-noise ratio of the bio-impedance signals.

**Title: Reinforcement Learning for Autonomous Vehicles**

*Author(s): Amogh Pandey*

*Primary URS Faculty Advisor: Dileep Kalathil, Ph.D.*

**Abstract:**

We are seeking to implement and deploy reinforcement learning (RL) algorithms for path planning, decision making, and navigation tasks in autonomous vehicles, and compare them to traditional control algorithms. Various control and reinforcement learning algorithms will be deployed in a simulation environment to test their performance on various navigation tasks (which will have to be designed and set up in the simulation environment), and will finally be deployed on a robotic car to study the performance of RL in real life autonomous driving tasks. Furthermore, the results will be used to hopefully establish RL as a viable alternative to control theory for autonomous navigation related tasks.

**Title: Research and Design of "SURGE" Health Facilities in an Urban Context: Seu Museu e Santuário**

*Author(s): Madison Lesmeister, Alanna Burnett*

*Primary URS Faculty Advisor: George J. Mann, AIA*

**Abstract:**

In an essence, Seu Museu e Santuário demonstrates the dichotomy between designing for a museum structure and designing for a "surge" facility. Surge capacity is a healthcare system's ability to both effectively and quickly expand beyond normal standard to meet a significant increased demand for medical care. Furthermore, surge hospitals have been described as alternative care sites that have been designed to supplement existing healthcare facilities in the case of a natural disaster, pandemic, terrorist attack, etc. Therefore, as architects and designers, it is important to design for these unforeseen and unpredictable disasters. The Seu Museu e Santuário, known as "Her Museum and Sanctuary," located in the urban context of Brasilia, Brazil, has been designed as a female art museum in its primary function. Moreover, in its secondary function, the museum is easily equipped to convert into an efficacious and strong alternate care facility in the event of a surge. As a whole, Seu Museu e Santuário speaks to and embraces the cultures, traditions, and vibrancy of Brazil while also being able to serve as a protected sanctuary for the community.

**Title: Revisiting the Foundations of International Law: The Peace of Westphalia and Sovereign Equality.**

*Author(s): Abigail Tacker*

*Primary URS Faculty Advisor: Dr. Cynthia Bouton*

**Abstract:**

Historians have generally accepted that the Peace of Westphalia (1648), which concluded the Thirty Years' War (1618-48), was the moment when the concept of sovereign equality, a concept that recognizes states have jurisdiction over their own territory and are all equal before international law, became an internationally recognized principle in diplomatic negotiations. However, recently some scholars have begun to reevaluate this assumption, claiming that the Peace did not actually establish the principle of sovereign equality throughout Europe. This reopening of a question considered answered has proved fruitful and encouraged this project's exploration of both the Peace itself and how subsequent politicians and diplomats actually deployed the Peace in their negotiations. This paper argues that, in international treaty negotiations, it may have mattered less to negotiators what the Peace actually said or formally established than what they argued it said and how they wielded it in their discussions. A close reading of the text of the Peace itself and subsequent negotiations between the 17<sup>th</sup> and 20<sup>th</sup> centuries reveals when and how diplomats wielded the Peace in their negotiations and to what effect. This project applies a close reading of the texts of several treaties and the various interpretations of it over time. It looks for specific references to the Peace of Westphalia in later peace treaties, analyzes what diplomats meant when they invoked it, and considers whether the treaties themselves resulted in outcomes that were consistent with the intent of the negotiators. Finally, it considers whether or not the Peace exercised the influence on international relations that some past scholars have claimed.

**Title: Rubidium Ionization Model for Interstellar Propulsion Concept**

*Author(s): Rohan Jillapalli*

*Primary URS Faculty Advisor: Christopher Limbach, Ph.D*

**Abstract:**

At the Laser Diagnostics and Plasma Devices Laboratory (LDPDL), Dr. Christopher Limbach and graduate student Hayden Morgan are working on a self-guided beamed propulsion concept that could be used on future interstellar missions. By firing high velocity rubidium atoms at the spacecraft, speeds up to 7.5% the speed of light could be achieved. One hurdle this project must overcome is how to protect the spacecraft from collisions with the high speed particles. A proposed solution is to have the spacecraft generate a magnetic field and have the particles impact this field rather than the spacecraft directly. In order for the particles to interact with the magnetic field, they must be ionized. This presentation will explain the work done to create a model for the ionization process of the rubidium atoms. A method known as two-step photo-ionization was chosen to ionize the particles. To create this model, radiative processes, beam attenuation, beam divergence, and laser/absorption lineshapes were all considered. An iterative method was developed to overcome the boundary condition problem that arose due to the layout of this mission concept. The final model can calculate the percentage of particles that will be ionized before impacting the spacecraft given various mission input parameters. The initial results showed that with realistic mission parameters the percentage of particles that would be ionized before reaching the spacecraft was too low. The cause for the low ionization percentage was found to be low efficiency ionization using the standard two-step photo-ionization method. A general overview of this project will be covered in this presentation.

**Title: Sadness Detection for Future Smart Homes**

*Author(s): Siyuan Yang*

*Primary URS Faculty Advisor: Anxiao (Andrew) Jiang, Ph.D.*

**Abstract:**

This paper focuses on sadness detection and recognition using deep learning and image processing in python. It analyzes accurate and efficient ways to collect a large set of “moments” from YouTube videos to build large-scale databases for “moments” that show the emotion of sadness. For the overall model architecture, a sequential neural network model was built with three fully connected convolutional layers and rectified linear units as our activation function. Initially, we obtained a nearly zero false positive rate and around ten percent false negative rate on this trained model. To further improve the accuracy and efficiency, Haar Cascade classifier is used to only crop frontal face images so that the model can precisely detect and analyze the facial expression. Besides, we crawled the YouTube network to acquire the video information and used natural language processing to filter the videos that are more likely to contain the emotion sadness. By incorporating the deep learning model with above algorithms, “moments” that contain the emotion of sadness were extracted from YouTube videos and output as a JSON file, which can be viewed via the iLab website.

**Title: Save Plastic Save Money: Recycling/Reusing Biological Plastic Wastes**

*Author(s): Arian Veyssi*

*Primary URS Faculty Advisor: Rashmi P. Mohanty*

**Abstract:**

Every year 80,000 pounds of biological waste is generated in the University of Texas (UT) at Austin campus, which is either incinerated at an offsite location or disposed of in a landfill by the Environmental Health and Safety Department (EHS). Plastic pipette tips are a significant percentage of this biological waste since around 200 wet laboratories on campus use glass or plastic pipette tips. Plastic pipette tips are commonly used in biomedical and pharmaceutical labs and are considered biologically contaminated and non-reusable after a single use, creating a significant environmental and economic problem. The aim of this study is to validate different washing and sterilization methods to remove bacteriophage contamination from plastic pipette tips. TipNovus, an automated washing machine commercially available from Grenova, is used by many biotechnology companies to reuse their pipette tips. This study performs two washing methods on plastic pipette tips-one is the protocol followed to wash glassware, and the other steps as suggested by Grenova. This study shall confirm the effectiveness of the washing steps by evaluating the percentage contaminates

remaining after each washing and sterilization. The most effective method will be selected to further verify the reusability of the pipette tips by performing an assay with the washed tips and comparing the results with that obtained from the experiment with fresh new tips. Further, the results of the study will be communicated to EHS, encouraging them to implement similar techniques in the campus to reuse and recycle pipette tips collected from different UT campuses.

**Title: Screening for Per and Polyfluoroalkyl Substances (PFAS) in Sea Turtles Blood and Tissue Samples**

*Author(s): Santiago Canel Soria*

*Primary URS Faculty Advisor: Yina Liu, Ph.D.*

**Abstract:**

Per-and Polyfluoroalkyl substances (PFAS) are synthetic chemicals that have the potential to bioaccumulate and biomagnify in the environment. PFAS are used in many industrial and consumer products due to their unique chemical properties. To name a few, PFAS are used extensively in non-stick pans, water and grease repellent fabrics, fire extinguishing foam, and certain plastics. Their wide range of applications has led to significant consequences in environmental health. PFAS exposure pathways include by way of particulate matter in the air and by water. In addition to their ambiguous modes of transportation, the ability of PFAS to bioaccumulate in the environment, in particular, marine life, is of concern. Leatherback sea turtles, which are considered endangered species, are unique for swimming long distances and long life span of 9-29 years. Therefore, the impact of PFAS in these animals is of particular interest. Leatherback sea turtles' blood serum will be screened for PFAS. Furthermore, a built upon methodology consisting of a QuEChERS salt extract and a dSPE step to clean the sea turtle blood serum, and two unique solid-phase extractions (SPE) for the capture of PFAS. Afterwards the analytes were screened for PFAS using a ultra-high liquid chromatography-tandem mass spectrometer (LCMSMS). Results from the screening of PFAS in sea turtle blood serum samples are pending. Provided that PFAS are resistant to biodegradation in the environment and have the potential to bioaccumulate and biomagnify in many marine species, an improved understanding of their chemical properties, distribution, contaminant pathways, and toxicity threshold should be researched further. Hence the provided findings could potentially bring substantial advancements to endocrinology research, PFAS mitigation practices, and the development of new standards on PFAS pollution.

**Title: Service Store Model and Tools for FRESCO Applications**

*Author(s): Arbin Bhuiyan, Michael Chacko*

*Primary URS Faculty Advisor: Guofei Gu, Ph. D.*

**Abstract:**

As the number of network connected devices grows, the necessity to secure them and the networks they reside on increases in lockstep. In recent years, software defined networking (SDN) has grown from its infancy, and has slowly established itself as a network security solution for commercial applications by offering a scalable mechanism to manipulate networks through direct manipulation of the switches within a network from a central controller. This ingenious architecture of SDNs allows for granular control over a network and its policies through manipulation of flow tables. In an effort to ease the burden of tedious packet level configurations via the flow table, FRESCO, a SDN application development framework, was created by Texas A&M's SUCCESS Lab in collaboration with SRI International. FRESCO is a SDN scripting language that facilitates manipulation of the SDN control panel via modules that manipulate the flow tables, eliminating the need for user interaction. In an effort to increase the adoption of SDN and FRESCO on the part of everyday consumers to increase network security, we present in this paper the FRESCO Service Store, a centralized resource for community created FRESCO modules, applications, and tutorials. In addition to the service store, we will also present the FRESCO AppBuilder, a GUI application to create FRESCO applications themselves, in order to make FRESCO more accessible to laymans. Finally, we present select FRESCO applications that address key network security topics in addition to the ones that have already been created during the initial development of FRESCO in 2017.

**Title: Shakespeare in the 18th and 19th Centuries**

*Author(s): Jillian Luna*

*Primary URS Faculty Advisor: Margaret Ezell, Ph.D.*

*Co-URS Faculty Advisor: Heidi Craig, M.Litt. Ph.D.*

**Abstract:**

My research looks at how the influence and importance of Shakespeare has changed throughout the 18<sup>th</sup> and 19<sup>th</sup> centuries by reviewing which works and phrases have been deemed as popular. Many studies have focused specifically on performances of Shakespeare or influences of Shakespeare throughout the 18<sup>th</sup> and 19<sup>th</sup> centuries. However, this project looks even closer at the use of various expressions, sonnets, and plays that are most present within each century. By looking at the “beauties” and commonplace books curated in the 18<sup>th</sup> and 19<sup>th</sup> century, the focus of the project considers what phrases were important and why they were significant in their time. Additionally, it explores how the literature, theater, and creators of the 18<sup>th</sup> and 19<sup>th</sup> century shaped Shakespeare’s popularity and impression on society. Considering all of these outside influences, my research notes specific phrases, passages, scenes, characters, and events within Shakespeare’s plays and other writings that gained recognition and, in turn, appeared most in 18<sup>th</sup> and 19<sup>th</sup> century texts. This assists in our current understanding of how Shakespeare’s status and audience grew and shifted over this period of time in a drastic way, impacting the way that we now read and analyze Shakespearean texts.

**Title: Simulation of Hypervelocity Sabot Separation**

*Author(s): James Leaverton*

*Primary URS Faculty Advisor: Thomas E. Lacy, Ph.D.*

**Abstract:**

The aerodynamic sabot discard process is crucial to the success of hypervelocity testing using less than ideal projectile launch properties or sub-caliber projectiles in smooth bore launchers. Achieving efficient sabot separation is integral to both reaching extreme velocities and capturing distinguishable impact phenomena during testing. In this paper, the conical-cup discard technique is investigated for four-petal sabot packages carrying 2-8 mm diameter spherical projectiles launched with the state-of-the-art 2-stage light gas gun located in the Texas A&M University Hypervelocity Impact Laboratory. Empirical models relating both environmental and launch parameters to the degree of sabot separation at a fixed distance from the muzzle are developed. Image processing techniques are employed to convert images of sabot petal impacts to coordinate entities. The degree of separation for each entity is then characterized by the distance travelled in the radial direction away from the axis of penetration. Simulations using computational fluid dynamics (CFD) code are conducted to model the discard motion during projectile flight. The present models show close agreement with the computational results, validating the accuracy of the simulation software in predicting separation in the HVI Lab’s 2-stage light gas gun. Computational agreement promotes streamlined sabot design for various new payloads, such as penetrators.

**Title: Simultaneous Skin-Electrode Impedance and Bio-Impedance Measurement for Cuffless Blood Pressure Monitoring**

*Author(s): Matija Jankovic*

*Primary URS Faculty Advisor: Roozbeh Jafari, Ph.D*

**Abstract:**

Cardiovascular disease (CVD) is the leading cause of death worldwide and is directly related to high blood pressure (BP). Consequently, there is a vital need to monitor BP continuously. Current BP measurement practices rely heavily on the use of an invasive and inconvenient cuff that only allows for sporadic measurements. Cuffless methods based on non-invasive sensors can be integrated into wearable devices such as smart watches to measure BP continuously. Current continuous monitoring solutions utilize bio-impedance sensors that are placed on the wrist arteries and measure the pulse transit time (PTT), which is the time delay of the pulse signal between two points along the artery and is correlated with BP. Bio-impedance is a non-invasive electrical signal that can measure blood volume changes at the sensor location and be used to monitor the arterial pulse wave. Bio-impedance sensors can be placed on the wrist in-line with the radial artery to extract bio-impedance signals, calculate the PTT, and hence estimate the BP. However, the accuracy

of the bio-impedance signal measured significantly affects the calculated PTT and estimated BP. Contact quality between the electrodes and skin as well as the misalignment of electrodes over the arteries, are two major limitations that cause inaccuracies in the estimated BP of wearable devices. Monitoring changes at the skin-electrode interface can provide valuable information that can account for signal distortion or noise. This research aims to monitor the skin-electrode impedance simultaneously with the bio-impedance to find a correlation between the two, which can be used to correct for variations in the bio-impedance DC and pulse amplitudes.

**Title: Socialization Forces Contributing to Women of Color in Politics**

*Author(s): Vivian Cassina*

*Primary URS Faculty Advisor: Brittany Perry*

**Abstract:**

The political efficacy of women of color is limited in various forms; efficacy is negatively affected by factors such as increased political unrest and racial prejudice within media representations (Richie B. 2000). Nonetheless, the Y2K era of politics demonstrates that women of color are experiencing a change in their view of their impact in politics. In order to understand these changes, it is imperative to analyze the common forms of influence that reinforce their perspectives. This paper will contextualize a modern interpretation of Preuh's (2007) research on the importance of minority representation and its relationship to mitigating harmful politics for people of color. Descriptive representation evolving to become more inclusive of Women of color as politicians is important because of their unique intersection of identities: the ability to act as representatives of women as well as those of a racial/ethnic minority group. The research will also seek to discover the intersection of positive descriptive representation within media and the effect on political efficacy through socialization. Socialization forces that the paper will address includes pop-culture examples of TV, cinema, opinion-reporting, music and social media. Data analysis will focus on women of color 18-23 years old who exclusively experienced the Y2K era of internet-based media outlets since early adolescence. In looking at patterns of socialization through a survey experiment, results are expected to demonstrate a clear correlation between Social Cognitive Theory and increased feelings of efficacy; these ideas transfer into the political realm through political discourse occurring on social media, and further spread by followings of influential individuals of pop-culture.

**Title: Song of the Night: The Lasting Effects of Childhood Trauma**

*Author(s): Aarushi Mudavangatil*

*Primary URS Faculty Advisor: Lowell M. White, Ph.D.*

**Abstract:**

Song of the Night is a creative piece that delves into the themes of child abuse and trauma and its lasting effects in adulthood. This work also talks about the onset of mental illnesses as well the stigma it carries in today's world. The main focus of this topic is given to Dissociative Identity Disorder, especially in the developmental stages. The concept of social status in society and the covering up of crimes with respect to status is also a key factor in this novel. The difference between a serial killer and an assassin is established in detail. The main idea of how emotional trauma and abuse affect decision-making as an adult is explored in this novel. Jackson Liu is an infamous, self-employed assassin in the city of Plano, Texas. A tattoo artist by day, he has created a name for himself amongst the general public as a vigilante who only targets the corrupt upper-class. He is aided by his girlfriend Zoe Power, a powerful criminal lawyer who represents these people in court—and also gives Jackson his targets. Zoe is the youngest in a family of well-known doctors in the city and is under the pressure of gaining her family's approval. Nisha Mehta is the fourteen-year-old daughter of a powerful business tycoon, Vikas Mehta; and a victim of her parents' abuse. The abuse escalates to the point where Nisha develops another identity to protect herself, and in the process learns about Jackson. She employs him to get rid of her family. Jackson and Zoe take Nisha in, not wanting her to be put into the system and Nisha's alter identity trains under Jackson to follow in his footsteps. Jackson does not kill her family and leaves that opportunity to her if she chooses to kill them.

**Title: Stability Assessment of PEO-Silane Amphiphiles for Use in Intraocular Lenses**

*Author(s): J Jesus Rodriguez Cruz*

*Primary URS Faculty Advisor: Melissa A. Grunlan, Ph.D.*

**Abstract:**

Extensive research has been performed on how surface modifying additives (SMAs) incorporated into silicone materials can enhance their hydrophilicity in order to achieve nonspecific protein adsorption resistance. Such resistance plays a crucial role in the development and design of blood-contacting medical devices like catheters, stents, and microfluidics. Regarding ophthalmic devices, cell encroachment is particularly pernicious for intraocular lenses (IOLs), many of which are silicone-based. Therefore, it is essential for these SMAs to exhibit exceptional surface properties which impart biocompatibility while maintaining hydrophilicity, bulk mechanical properties, and optical clarity of the material necessary for IOLs. Our lab previously utilized poly (ethylene oxide) (PEO)-silane amphiphiles incorporated into silicones as SMAs, demonstrating significant improvements in surface hydrophilicity as well as resistance to proteins and bacteria. Although studies provide coherent explanations of surface modifications, stability assessments of the additive and studies of its impact on bulk properties of silicone biomaterials are often limited. Because a thorough assessment on stability of SMAs will provide an enhanced understanding of anti-biofouling properties, this project aims to develop a quantitative analysis of the chemical and physical stability of amphiphilic additives incorporated into silicone materials. To achieve this, films composed of medical grade phenyl silicones were modified with varying concentrations of PEO-silane amphiphiles. We will perform mechanical and optical testing to study stability of PEO-silane amphiphiles at different concentrations, as well as its impacts hydrophilicity and similar structural integrity to pristine phenyl silicones.

**Title: Static Race Detection Tool For Go**

*Author(s): Lorna Sanders*

*Primary URS Faculty Advisor: Shaoming Huang*

**Abstract:**

The built-in race detection tool works dynamically, so it finds races at runtime which can lead to false negatives. The static race detection tool on the other hand analyzes all code regardless of what happens on one particular runtime allowing it to find the races that the dynamic tool cannot. The tool converts the code to SSA code for more easily analyzable data that does not need to be run dynamically. Then, the tool establishes an understanding of what instructions are read or write instructions, and analyzes what instructions have a happens before relation, meaning that one always happens before the other. If a happens before relation is found or the instructions are not either a write and a read instruction or a write and a write instruction, a data race between those two instructions is impossible and can be eliminated. With those baseline conditions, the tool was then be tested on real world data races to progressively make the tool more accurate. In the course of this real-world data race testing, the tool has been quite accurate in ensuring no false negatives occur. The goal of the tool was to have any misreported races be false positives rather than false negatives to be an improvement on the dynamic tool. That goal has been ensured as testing has gone on. The static tool is as expected, slower than the dynamic tool due to the nature of static analysis, however it brings a new benefit to the race detection tool world by having any errors be false positives while the dynamic tool in contrast gives false negatives. Programmers in Go can now use those two endpoints to more accurately find races knowing the respective benefits each tool can give separately and in conjunction with each other.

**Title: Stock Market Circuit Breakers and Market Volatility**

*Author(s): John Isbell*

*Primary URS Faculty Advisor: Tatevik Sekhposyan, Ph.D.*

*Co-URS Faculty Advisor: Danila Serra, Ph.D.*

**Abstract:**

With the rapid fall of the S&P 500 index throughout March 2020, some economists and analysts have begun to question the effectiveness of stock index circuit breakers. The SEC sets S&P 500 index circuit breakers at specific price drops, such as a 7 percent price change from the previous trading day's closing price. Further questions were raised after circuit breakers were triggered four times in March 2020. Whether a Level 1, 2, or



3 circuit breaker for the S&P 500 is triggered, trading across all stock market platforms halts for a minimum of 15 minutes. Also, longer trading halts may occur depending on the price percentage change and time during normal trading hours. These circuit breakers are meant to allow traders additional time to think about changes in the market and their investment positions during trading halts. Despite the precautionary measures taken with circuit breakers to protect financial markets, some argue they exacerbate market volatility by allowing nervous investors additional time to sell large equity positions. This thesis will analyze high-frequency, 15-minute interval S&P 500, S&P 500-based realized volatility and CBOE Option-Implied Volatility data from each of the four March 2020 incidents to determine the impact of a circuit breaker's triggering on market volatility and index price. In addition, other influential factors, or current events in March, would potentially play a role in furthering market downfall. These other factors include the spread of COVID-19, uncertainty over upcoming Q2 corporate earnings, and the Saudi-Arabia oil price war. In conclusion, the triggering of stock market circuit breakers during the COVID-19 market downfall will increase market volatility and negatively affect shareholders' returns on equity investments.

**Title: Studying the evolution of the Fornax dwarf galaxy**

*Author(s): Anuj Kankani*

*Primary URS Faculty Advisor: Louis Strigari, Ph.D.*

**Abstract:**

We use N-body simulations to study the evolution of the Fornax dwarf spheroidal galaxy. Specifically, through simulating a two component Fornax model on an observationally motivated orbit through a static Milky Way potential, we study the effects of tides on the internal structure of Fornax, and its globular clusters. We adopt a cuspy NFW and a cored Burkert halo, as well as a contracted Sersic bulge, extending out to about 2.65 kpc, and an extended Plummer bulge, extending out to about 6 kpc. We find that the internal structure of Fornax is largely unaffected by tidal effects, with a extended bulge causing a maximum of 7% of its original stellar mass to become unbound, while a contracted bulge results in a maximum of 2% of its original stellar mass to become unbound. For globular clusters, we find that both a cuspy and cored halo is consistent with observations, but a cored halo allows for more flexible formation scenarios. We find that in certain scenarios the Milky Way can have a small impact on globular cluster orbits. Furthermore, we were unable to replicate a previously reported effect where globular clusters placed inside the core radius of a large core halo increased its distance from the center of Fornax. Lastly, we find the softening length of the host galaxy has a significant effect on globular cluster simulations and must be taken into account when comparing previous work.

**Title: Survival Analysis Benchmarks for Clinical Time Series Data**

*Author(s): James Royalty*

*Primary URS Faculty Advisor: Bobak Mortazavi, Ph.D.*

**Abstract:**

The rise in publicly available healthcare databases, such as MIMIC and the eICU, now make it possible to revolutionize medical care when paired with modern machine learning techniques. The MIMIC-IV critical care database allows us to explore these techniques in the ICU setting using data from thousands of patients. One area that can be improved upon in the medical domain is prediction of events in the ICU setting, such as whether a patient will have a heart attack during their stay. Through improved prediction of events, hospitals can be more efficient and better allocate resources to patients who need it most, saving both lives and costs. In the ICU setting, there has been previous work for prediction of events via machine learning classification models. However, we believe time-to-event models may offer more accuracy and interpretability than these classification models. Time-to-event models predict the probability a patient will experience a particular event over the course of their stay. To perform these benchmark tests on the MIMIC-IV database, we refactored code used in preprocessing the MIMIC-III database for the previously mentioned classification tasks. We then implemented baseline time-to-event models and compared them to the classification models. We then developed deep mixtures of time-to-event models to see how these compared to the previous classification benchmarks and baseline time-to-event models.

**Title: Systematic Design of Natural Gas and CO2 Utilization Networks in Industrial Clusters**

*Author(s): Bandar Al-Abdulla, Lolwa Al-Kubaisi, Aysha Melhim*

*Primary URS Faculty Advisor: Dhabia Al-Mohannadi, Ph.D*

*Co-URS Faculty Advisor: Patrick Linke, Ph.D*

**Abstract:**

In the past decades, carbon dioxide (CO<sub>2</sub>) emissions have been increasing alongside their negative effects on the environment. The most notable harm is the increase in global average surface temperatures. Governmental efforts, such as the Kyoto Protocol and the Paris Agreement, have been regulated, since 1997, to aid in the reduction of emissions. Carbon emissions can be reduced in several ways, including renewables and Carbon Capture, Utilization, and Storage (CCUS). CCUS is a sustainable and cost-effective way to reduce emissions from highly polluting industries such as cement, steel, and the chemical processing sector. Capturing and treating CO<sub>2</sub> emissions is a crucial step in carbon integration in which CO<sub>2</sub> is captured and used as a feedstock with natural gas to produce many hydrocarbon-based products such as methanol, ammonia, and hydrogen production. In this paper, a systematic approach on how to allocate and monetize natural gas networks sustainably will be explored. The allocation will be done on a multi-period basis through building a multi-integer linear program to reduce CO<sub>2</sub> emissions from industrial clusters to mitigate climate change. Furthermore, emerging technologies such as the electrochemical carbon dioxide reduction approach will be further investigated as a non-conventional method to reduce carbon dioxide emissions. In addition to analyzing changes, such as the decrease in demand for natural gas due to COVID-19 and climate change. Renewable energy sources, such as solar energy, have been widely considered as the next step towards a decarbonized world. As a result, this paper will also explore the effect of replacing part of the power grid with renewable energy sources to reduce the emissions from natural gas-fired power plants.

**Title: THE GENDER WAGE GAP: POLICY, ENFORCEMENT, AND GOVERNMENT COMPOSITION**

*Author(s): Austen Siegler*

*Primary URS Faculty Advisor: Dr. Alexander C. Pacek*

**Abstract:**

By 2014, women were earning about 79 percent of what men were earning on the dollar-- a mere 7-point increase from 1989. This certainly begs the question: why has wage convergence among men and women seemingly plateaued? Why did that substantial increase in wage convergence during the 80's not persist over the ensuing 20 years? The answer: we have been pointing in the wrong direction. Long-established explanations such that of human capital factors more so explain the gender wage gap aggregate of the past; Approximately 27 percent of the gender wage gap could be explained by human capital factors during the 1980 period, but by 2010, that number had reduced down to just 8 percent. Economists and pundits, acknowledging this reality, have begun scrutinizing the portion of the gender wage gap not accounted for by gender differences in measured qualifications; this portion of the gender wage gap is more formally referred to as the unexplained gender wage gap. Exciting new research details the salience of variables such as negotiation, competition, and risk aversion in explaining the unexplained gender wage gap. Indeed, determinants such as these are chief contributors to the unexplained gender wage gap but the role of policy as an additional variable contributing to this problem is often understated. My theory is as follows: certain progressive policies such as maternity leave, quotas, and equal pay legislation decrease the gender wage gap most significantly but the effectiveness of such is thereby tempered (or bolstered) by the enforcement of policy and by the composition of government ( partisanship and gender ratio in government). With more women in government, I expect the gender wage gap to decrease in turn. Furthermore, I expect the gender wage gap to decrease accordingly to a more liberal administration. I will test my theory by conducting a statistical analysis on advanced industrialized democracies over 5-year increments. The effectiveness of a policy will be measured by a change in the wage gap. If my theory is correct, then my work has the potential of redirecting the general focus of research on the variables affecting the gender wage gap.

**Title: THE IMPORTANCE OF COMMUNITY: CONCEPTUALIZING HEALTH AS PARTICIPATION IN THE WORLD**

*Author(s): Erin Nugent*

*Primary URS Faculty Advisor: Kristi Sweet*

**Abstract:**

This project suggests how can human health be understood as a function of participation in community by considering the current biomedical model, shortcomings of this model, and a conceptualization of health indexed to flourishing within community. I begin with an analysis of the biomedical model. I consider how the various features of the model, including its infamous reductionism and mechanism, have led to undesirable consequences as aspects of human health are disregarded. I contextualize the current biomedical model's measure of health and suggest that such a standard fails to encompass all of human experience. I then discuss the history of health utilizing the work of Philip J. Van Der Eijk, illustrating historical conceptions of health to suggest that medicalization of the body and repudiation of the non-physical has failed to serve humans well. I suggest that a new conception of health will involve a reconsideration of what medicine has turned away from but without problematic implications. The final part of my paper considers health and sickness via community. I suggest that to be human is to be a member of community, and thus health can be understood via participation in the community. I draw upon the ideas of Wendell Berry and Hans-Georg Gadamer to suggest that healing is a restoration of an individual to community and normal function. I provide analysis for this perspective and highlight how this contrasts with current medicine, emphasizing the importance of membership within health. Once I show health to be a function of community, I conclude the paper by drawing conclusions and providing suggestions for how medicine can more fully undertake the practice of healing and allow for human flourishing.

**Title: THEORETICAL COMPUTATIONS FOR RING-PUCKERING POTENTIAL ENERGY FUNCTIONS OF FLUOROCYCLOBUTANES**

*Author(s): Luma Almahbobi*

*Primary URS Faculty Advisor: Jaan Laane, Ph.D.*

*Co-URS Faculty Advisor: Esther Ocola, Ph.D.*

*Co-URS Faculty Advisor: Tawfik Hussein, Ph.D.*

**Abstract:**

Ring-puckering vibrations of four-membered rings have been extensively studied over the past fifty years due to their non-rigidity and puckered to planar vibrational energies. Ring-puckering coordinates have been used to predict the potential energy functions (PEFs) of these molecules. PEFs help understand different processes such as inversion and isomerization. In this work, PEFs of all possible fluorine substitutions on cyclobutane ring were calculated using MP2 ab initio methods based on the Moller-Plesset Perturbation theory. Their Kinetic expansion function will be obtained. The barrier to planarity and puckering angles will determine the PEF coefficients.

**Title: Texan Identity and the Republican Party: A Social Semiotic Analysis of Political Artifacts**

*Author(s): Yzach Dominguez Dominguez*

*Primary URS Faculty Advisor: Gabriela C. Zapata, Ph.D.*

**Abstract:**

The purpose of this work is to apply social semiotics in the analysis of campaign artifacts belonging to two Texas Republican officials, U.S. Congressman Dan Crenshaw and U.S. Senator Ted Cruz, in order to uncover the messages they wish to convey to their constituents. Artifacts consist of social media posts made by these two officials on Twitter, Facebook, Instagram, and YouTube. These artifacts provide all the necessary information required for the application of social semiotics since they include a variety of semiotics resources (e.g., written, visual, gestural). This work focuses on these politicians' use of symbols associated with Texas, the national Republican Party, and the Republican Party of Texas. The analysis begins by identifying the modes and semiotic resources used within an artifact. The next step is to identify the interaction between the modes and semiotic resources. Afterwards, cultural and societal context is applied to the artifact. By completing these steps, the intended message behind the artifact can be uncovered. The results will reveal which Texas symbols are used to appeal to Texas voters, the relationship between the symbols and the Republican Party, and the motivations

behind the use of such symbols in campaign artifacts. The findings of this work will grant a deeper insight as to how Texas Republican politicians appeal to their constituents.

**Title: Texas State Parks and the Effect of COVID-19 on their Communication Styles and Frequencies**

*Author(s): Hannah Chambers*

*Primary URS Faculty Advisor: Tobin Redwine, Ph.D.*

**Abstract:**

This research looks at individual Texas state park Instagram accounts and first-hand feedback from park visitors to analyze how parks used Instagram to communicate with their audiences and how people responded to the posts during COVID-19. This study uses quantitative research and descriptive statistics of social media analytics to define Texas State Park accounts' social media usage and strategy by analyzing the number of information posts made by a park and the average engagement. Additionally, this study utilizes qualitative research through semi-structured interviews with Texas State Park visitors and media consumers aged 18-25 to see if they used Instagram as a source of information on park closures and updates during COVID-19. Participants reported on the parks' communication effectiveness using Instagram and how they think the park can better convey the parks' offerings to the consumer. The research indicates that informative posts do not adequately demonstrate their engagement through analytics. Park visitors are seeing the informative posts and utilizing the information when considering visiting a park, but typically do not engage with them through likes or comments. Additionally, visitors wish to see more content about what the park has to offer including campsites and their locations within the park, trails and what visitors can see on them, and local wildlife.

**Title: That Tall, Skinny, Green Hill**

*Author(s): Ryan Steel*

*Primary URS Faculty Advisor: Dr. Jason Harris*

**Abstract:**

This thesis explores the effects of trauma on relationships with parents, peers, and neighbors. It also looks into plot and scene structures of the fantasy style alongside different world-building techniques. The creative artifact contains excerpts from *That Tall, Skinny, Green Hill*—a coming-of-age, fantasy, adventure novel. It stars a boy named Cast Klyosov, who looks at the world through a different lens than others, and his mostly even-tempered friend, Dosiner Eldwin Hasden III, who prefers to go by Dox so he can escape comparison to his strict and overbearing grandfather of the same name. Cast Klyosov was only seven-years-old when he first saw the great, green mass of Lalbahadoor's neck, whose back Cast's world lives upon, stretching into the clouds above. *That Tall, Skinny, Green Hill* follows the story of Cast, Dox, and their friends as they try to save their small, kingdom-edge village from the clutches of a malicious creature that has mysteriously appeared in the nearby mountain woods. The boys will learn to face death, come face-to-face with a self-proclaiming god, and work to survive the ongoing traumas they endure.

**Title: The American Paradox and Reading as Self-Help**

*Author(s): Jacqueline White*

*Primary URS Faculty Advisor: Dr. Marian Eide*

**Abstract:**

At the same time that our country is witnessing a decline in interest in the humanities, American readers are becoming increasingly involved in serious reading practices. Such reading practices have proliferated from online forums provided by celebrities like Oprah Winfrey and Reese Witherspoon, to in-person book clubs. This thesis aims to understand the phenomenon through a cultural theory I have named "The American Paradox." Using scholarly sources, interviews with readers of all ages, and book club observations, I explain the American Dream's influence on reading practices in the United States to argue that book clubs have emerged as a communal form of self-help. How is reading as self-help inherently American? Today, upward mobility in regards to the American Dream has become less about monetary gain and more about individual growth. My main theory, the American Paradox, argues that the inner motivation of the American Dream compels individuals to gain a certain capital—cultural capital. American individuals view their lives aspirationally and

often use reading— both serious and recreational — as a means to enhance their bourgeois status and improve their quality of life.

**Title: The Effect of Substance P on Hemorrhage and Secondary Injury after Spinal Cord Injury**

*Author(s): Billie Nguyen*

*Primary URS Faculty Advisor: James W. Grau, Ph.D.*

**Abstract:**

Spinal cord injury (SCI) is a life-altering event that can have lasting effects on one's life. While the initial injury has devastating consequences for the individual, SCI is often accompanied by further injuries that not only engage nociceptive fibers, but also can lead to the development of chronic pain and locomotor deficits, among other detrimental effects. Previous work has shown that pain input after SCI has an adverse effect recovery due to increased hemorrhage and secondary injury. Substance P (SP) is a neuropeptide that acts as a messenger of injury and pain, and its effects on secondary injury and recovery after SCI are largely unknown. The present study sought to determine the effects of SP after SCI and whether the administration of SP is linked to the induction of hemorrhage. Previous studies hint at a mixed effect of SP, as there is considerable evidence for both an anti-nociceptive effect and an adverse effect. Male Sprague-Dawley rats were given a moderate spinal cord injury at the lower thoracic spinal cord and allowed to recover for twenty-four hours. Substance P, or its vehicle, was then applied to the spinal cord through an intrathecal catheter. Locomotor recovery and blood pressure were assessed at hourly intervals for 3 hours. Animals were then euthanized with pentobarbital and the injured region of the spinal cord tissue was collected. Hemorrhage was assessed by measuring light absorbance at the wavelength associated with hemoglobin (420 nm), the Drabkin's assay, and Western blotting.

**Title: The Effect of a Traditional Ballet Barre Versus a Modified Ballet Barre on Flexibility, Ankle Stability, and Abdominal Strength in Collegiate Dancers**

*Author(s): Meghan Wehmeyer, Carissa Weaver*

*Primary URS Faculty Advisor: Christine Bergeron*

**Abstract:**

The knowledge of dance science has led towards prioritizing the physical health of the dancer while still preserving the art's history. Previous research has revealed that safe practices in a dance class include a dynamic warm-up, less dependence on the barre itself, and withholding static stretching until the conclusion of the class. This study compared the effect of two different structures of ballet barre on the flexibility, ankle stability, and abdominal strength of collegiate dancers. The three groups being compared are the traditional ballet barre (TBB), the dance science ballet barre (DScBB), and the control group, with 2 college-age female participants in each group. TBB participated in a class based on the traditional ballet structure, starting with plies, static stretching in the middle of class, and using the ballet barre. DScBB participated in a class taught based on dance science research including the absence of a ballet barre, a ballet-specific dynamic warm-up, and withholding static stretching until the end of the class. Each class was taught once a week over Zoom for an 8 week period at a college intermediate level and maintained the same structure each week. Pre and post-testing were completed to measure hamstring flexibility, ankle stability, and abdominal strength. The results failed to reject the null hypothesis and were not statistically significant due to some restraints. There was a correlation between the DScBB and the abdominal strength of the dancers shown in the specific abdominal tests. Measured in the tests, the DScBB group's abdominal strength increased, while the TBB decreased. Future studies should be done to provide ballet teachers with a barre structure that prioritizes the dancer's physical health while preserving ballet's history.

**Title: The Effects of Neural Tension on Hamstring Flexibility in Collegiate Dancers: Neural Gliding vs. Dynamic Stretching**

*Author(s): Kailyn Williams, Ella Cox, Julianna Barraza*

*Primary URS Faculty Advisor: Carisa Armstrong*

**Abstract:**

Dancers are required to have extraordinary hamstring flexibility in order to conform to the demanding physical standards of many dance genres. Neural gliding is a technique used to increase mobility in the nervous system itself or in surrounding muscular structures. Dynamic stretching is an active form of stretching, used to strengthen and increase the range of motion within the muscles and joints. The purpose of the study was to compare and contrast the effects of integrating dynamic stretching or neural gliding techniques into a dancer's training regimen in order to improve overall hamstring flexibility. Twenty-one female collegiate dancers, ages 18-22, participated in the study. The participants were randomly divided into three groups: dynamic stretching group (DS), neural gliding group (NG), and control group (CG). DS had seven participants, the NG had eight participants and the CG had six participants. All groups completed a pre, mid and post test looking at hamstring flexibility. Participants in the DS and NG completed 8 weeks of intervention training including: a general warm-up, a stretching routine specific to their group and a general cool-down. There were no statistically significant differences between groups. Although, it was observed that the DG had the largest improvement on the right side in hamstring flexibility compared to the NG and CG. The left side measurements yielded no real improvement in hamstring flexibility for any group. Not all participants tested positive for neural tension during the pre test. This inconsistency may have contributed to the lack of improvement in hamstring flexibility for the NG. Further research is needed to see if neural gliding can lead to improved hamstring flexibility for individuals who present with neural tension.

**Title: The Effects of Pishing and Playback on Avian Fitness**

*Author(s): Mariel Ortega*

*Primary URS Faculty Advisor: Jacquelyn K Grace, Ph.D.*

**Abstract:**

Playback and pishing are auditory stimuli used by researchers, tour guides, and amateur birders to facilitate viewing or detection of a bird. Playback, playing recordings of territorial songs or contact calls, and pishing, making a small, repetitive noise, stimulate a territorial or defensive response. Previous studies have found an increase in vocalization and reduction of self-maintenance, foraging, and movement behaviors. Concerns have been raised about potential negative impacts of playback and pishing on avian long-term fitness, as a result of behavioral shifts caused by these techniques. We studied the effects of pishing and playback on behavior of wintering birds in College Station, TX. Pishing and playback treatments were administered for five minutes in sets of five days with two day rest periods for four weeks. Behaviors were noted at 30 instantaneous intervals before, during, and after treatment for 45 minutes of observation. Behaviors noted were singing, calling, chasing, flitting, flying, perching, foraging, and displaying. Species and distances of birds were noted. Preliminary analysis of the pilot study showed that birds vocalized more during the treatment, but there was no significant difference in the post-treatment period. This indicates that behavioral shifts lasted less than fifteen minutes after exposure to pishing and playback. The results of this study will be able to guide regulations about the use of playback and pishing, an ever-increasing concern as the popularity of birding increases.

**Title: The Egg and Avocado Show**

*Author(s): Cheryl Cruz*

*Primary URS Faculty Advisor: Samuel Woodfin*

**Abstract:**

*The Egg and Avocado Show* creative thesis is a cartoon series following the protagonists, Egg and Avocado, through a mockumentary-style musical talk show formatted as a collection of short animations. As each episode delves into its own ideas and commentary on internet culture, the series will also feature an overarching story of the two characters' "online journey" as they gain fame and traction, and by some stroke of luck, get picked up by a network. The project will explore themes of the disingenuousness of maintaining an

online presence, chasing fame rather than staying true to one's own creative voice, and the difference between professional entertainment and working as an independent creator.

**Title: The Impact of ShotSpotter on Violent Crime: A Study on the Effectiveness of Implementing Acoustic Gunshot Detection Technology to Improve Policing**

*Author(s): Samantha Kim*

*Primary URS Faculty Advisor: Jennifer Doleac, Ph.D*

**Abstract:**

This study will seek to examine the relationship between ShotSpotter technology and the rate of violent crimes within cities across the United States. In recent years, the ShotSpotter technology has become more prevalent as it has been implemented in over 100 cities and counties in an effort to combat crime. Developers sought to more effectively identify, investigate, and prosecute gun-involved crimes, as well as fix the traditional issues of underreporting and the lack of accurate and timely information associated with crime. This paper analyzes the effectiveness of the technology in measuring its observable effects on violent crime rates. Utilizing a generalized difference-in-difference model, the study examines the violent crime rates pre- and post-ShotSpotter and compares the variation to the cities that never utilized the technology. The effect of ShotSpotter, as implemented in each city, was found to have a significant negative effect on violent crimes.

**Title: The Interactions of and Protection Against High-Energy, Galactic Cosmic Rays on Eye Tissue**

*Author(s): Bridger Freeman*

*Primary URS Faculty Advisor: Dr. Galina Tsvetkova, Ph.D.*

**Abstract:**

As the interest in space exploration becomes ever more relevant, so too do the health risks of space. For humans, the eyes are one of the most vulnerable organs to radiation in space. Though there is notable previous research that explored the holistic effects of cosmic rays on the body, much of this research either exclusively considered low-weight ions, which are far more common due to lower-energy solar radiation, or it analyzed dose-dependent, pathological effects such as cataracts or cancer. In this work, the Translation of Ions in Matter (TRIM) software was used to analyze the interactions, range, and damage that incident nuclei inflict on exposed eye tissue at 20 MeV, 1 GeV, and 10.08 GeV. This software simulated the interactions that high-energy, galactic cosmic rays would have on an astronaut's eyes. Through this, an in-depth analysis of the way that high-energy cosmic rays interact with the eyes of astronauts in space was performed to better understand the relationship between nuclear mass and range, ionization, straggling, energy loss, and tissue damage. The efficacy that practical, high-density polycarbonate and metal shielding has on protecting the eye from these ions was also tested. It was found that though the gold-coated polycarbonate visor was effective at protecting against lower-energy or heavier particles, it was ineffective at shielding against high-energy cosmic rays above 1 GeV. However, mere millimeters of lead and aluminum were found to effectively shield a vast majority of the damage from these incident particles. It was suggested that recent advancements in head-mounted devices such as virtual-reality headsets may permit the utilization of this radiation shielding while overcoming obstruction to visibility that may have otherwise been an issue.

**Title: The Intersection of Function-as-a-Service and Stream Computing**

*Author(s): Trevor Bolton*

*Primary URS Faculty Advisor: Dilma Da Silva, Ph.D.*

**Abstract:**

With a lot of advancements in the field of computing including the emergence of cloud computing, the consumption and accessibility of computational resources have increased drastically. Although there have been great movements towards more sustainable computing, there are many more steps to be taken to decrease the amount of energy consumed and greenhouse gases released from the computing sector. Historically, the switch from on-premise to cloud computing has lead to less energy consumption. By releasing direct control of the hardware that their software is run on, an organization can increase efficiency and reduce costs. A new development of cloud computing has been serverless computing. Even though the term

"serverless" is a misnomer because all applications are still run on servers, serverless lets an organization resign another level of control, managing instances of virtual machines, to their cloud provider in order to reduce their cost. The cloud provider then provisions resources on-demand leaving less idle time. This reduction of idle time is a direct reduction of computing resources used, therefore a decrease in energy consumption. One form of serverless computing, Function-as-a-Service(FaaS), has a promising future replacing some stream computing applications with FaaS in order to increase efficiency and reduce waste. To evaluate these possibilities, benchmarking of stream computing using the traditional methods and stream computing using FaaS is being completed in order to compare what types of stream applications should be implemented in FaaS instead

**Title: The Language of the Law: Incarcerated Transwomen, Healthcare, and Human Rights**

*Author(s): Megha Viswanath*

*Primary URS Faculty Advisor: Vanita Reddy*

*Co-URS Faculty Advisor: Dinah Hannaford*

**Abstract:**

This project will identify specific legislation and laws that contribute to the denial of healthcare to incarcerated Transwomen and identify changes in these existing laws that could improve the experience of this distinct group of incarcerated individuals within the criminal justice system. This project is also pertinent to the current political climate due to the Trump administration's active efforts to decrease protections and rights for the LGBTQ community while working to increase police enforcement and incarceration over this group. My research questions seek to examine the limitations and possibilities of framing incarcerated transwomen's lack of access to health care as a human rights issue. I seek to address how the denial of specific forms of health care - hormones, gender reassignment surgery, and therapy - violates human rights definitions of the right to equality and freedom from discrimination, the freedom from torture and degrading treatment, and the right to equality before the law. I hope to do this by analyzing specific cases. Furthermore, I hope to explore the gendered nature of human rights, the inclusion of Transwomen and women within human rights frameworks, how both gender and race are treated under this framework, and how the category of "human" itself is characterized by the current human rights discourse.

**Title: The Moana Resort - Survey and Design of Alternate Care Sites for Disaster and Pandemic Relief**

*Author(s): Nallely Chavarria*

*Primary URS Faculty Advisor: George J. Mann, AIA*

**Abstract:**

Hospitals have faced a crisis-level shortage of beds as COVID-19 has surged across the globe, and designers have created different approaches to solve the lack of space. In my design studio, my partner, Ethan Vickers and I have designed the Moana Resort. It is located in Honolulu, Hawaii, and is a proposed Boutique Hotel that can be converted into a "SURGE" Hospital for a local or global emergency. The resort is surrounded by other hotels, plenty of retail shops, restaurants and is walking distance to two beaches, one being Waikiki beach. The resort itself has amenities such as a pool, hot-tube, garden, outdoor bar, a gym, a computer lab, and a restaurant. There are a total of 36 rooms, 24 that are standard and 12 of which are suites. Located at the back of the site is a parking garage to ensure that there is plenty of parking for guests and employees. When converted into a "SURGE" hospital, the resort layout allows for a quick and easy change. The kitchen and restaurant is only for staff, the lobby furniture is limited to reduce the spread of any infection, the ballroom is transformed into a central care center, the gym becomes a space for critical care and sterile equipment storage that is separated by a partition wall. The hotel rooms are turned into patient rooms and guest rooms for traveling staff. Overall, the hotel design is a solution to accommodating citizens in the event of a crisis, while incorporating sustainability in Hawaii from the choice of materials and access to natural lighting, overall creating a restful environment.



**Title: The Phenotypic and Genomic Consequences of Transposable Elements in *C. elegans* Bergerac strains**

*Author(s): Austin Daigle*

*Primary URS Faculty Advisor: Dr. Vaishali Katju*

**Abstract:**

*Caenorhabditis elegans* is a model organism used to study genomics because it is easy to manipulate experimentally, yet complex enough to yield major insights into molecular evolution in multicellular eukaryotes. One of the earliest samples of *C. elegans* was isolated in Bergerac, France. This sample was shared and maintained in separate labs prior to the invention of long-term cryopreservation methods, leading to the development of distinct strains. Early estimates indicated that a Bergerac strain had a high copy-number of the transposable element Tc1. Transposable elements (TEs) are genes that are able to move to new locations, leading to the disruption of other genes and manifestation of deleterious phenotypes. Discovering the cause of Tc1 proliferation in the Bergerac strains could reveal how TEs can evade regulation. In order to clarify the extent of phenotypic disruption caused by high TE copy number, three fitness traits (developmental rate, longevity, and survivorship) were analyzed in three Bergerac strains and compared to a wildtype control. The Bergerac strains were shown to have significantly reduced fitness compared to the control for all traits measured, and certain traits showed significant differences between strains. To understand the molecular basis for these differences, whole genome sequencing was completed on each Bergerac strain. The exact Tc1 copy number for each strain was estimated using the program RelocaTE, and increased Tc1 copy number was shown to be correlated with decreased fitness. Future endeavors include the completion of a final fitness assay (productivity), the identification of TE-disrupted genes, a search for mutations associated with TE proliferation, and a comparison of the relative amount of RNA transcripts in the Bergerac strains.

**Title: The Political Roadmap: How to Navigate Politics Without One**

*Author(s): Amber Mannie*

*Primary URS Faculty Advisor: Erik Peterson*

**Abstract:**

This piece includes research and in depth analyses of the African American voting bloc with the independent variable being whether or not the voter has obtained a post-secondary education. The Black voting bloc remains a vital, but understudied demographic in American history. The writing includes various scholarly statistics and in-depth research of the historic voting patterns of African-Americans. I have decided to test the theory of higher education having a positive correlation with African-American voting rates. Throughout this piece the research aids in determining whether there is a positive, negative, or net correlation effect on the Black voting bloc and their obtainment of a post-secondary education. Throughout this piece, although we are focused on one aspect and proving or disproving its validity, we have taken into account the longstanding and historic challenges African Americans have faced that will always serve as an effect on this demographic's voting patterns overtime. This piece is to serve more as a critical thinking and research based piece to add to, or flesh out the literature surrounding Black voting patterns. There have been statistics included from several different codebooks, textbooks, political-science journals, and many other academic resources. The factually-based thesis steers away from opinion and attempts to incorporate or debunk theories that have been surrounding the Black voting bloc and their patterns of voting.

**Title: The Politics of the Pandemic**

*Author(s): Ida Balakrishna*

*Primary URS Faculty Advisor: Scott J. Cook, Ph.D.*

**Abstract:**

The COVID-19 pandemic has been sweeping across the world, and since March over 100 million individuals have been infected and over 2 million have died due to the virus. While vaccines have been developed and distributed in record time, the virus has revealed weaknesses present in democratic and global institutions that have been traditionally viewed as the gold standard for public health policy. More specifically, technologically and scientifically advanced western democracies such as the United States have failed to implement successful policies to stem the spread of the virus while authoritarian countries such as China have been able to control the virus through aggressive lockdowns. On the other hand, democracies such as South

Korea and New Zealand have successfully reduced the spread of the virus through extensive contact tracing and quarantines while some authoritarian countries such as Russia are experiencing rapid increases in cases count. here is growing amount of research being done on the public health policies that are effective in reducing the COVID-19 growth rate. Policies such as lockdowns, shelter-in-place orders, mask mandates, contact tracing, social-distancing mandates, etc. have been implemented in various countries with various results. The goal of this research project is to analyze the effect of regime type of countries on the types of policies enacted and the number of COVID-19 cases/deaths by creating and applying regression models.

**Title: The Presence of Racism on Campus: How Effective Are Difficult Dialogues at Addressing Racism?**

*Author(s): Jayln Lee-Edoh*

*Primary URS Faculty Advisor: Srividya Ramasubramanian, Ph.D*

**Abstract:**

Systemic racism continues to be an issue on university campuses, especially those that are predominately white. Previous research has found this type of treatment to negatively affect people of color's performance and mental health. Commitment to diversity and a positive racial environment on campus aids in the college success of students of color. Implementing difficult dialogue sessions has raised awareness and provided a safe space for students, staff, and faculty to openly discuss racism. Successful difficult dialogue sessions have the power to identify what collective actions are necessary to implement social change on campus. Through these sessions, participants are faced with discussing racism that occurs at their university. Trained notetakers will record the responses of the participants during each session. After, participants complete a survey about their experience upon completing a difficult dialogue session. Through a quantitative approach, participant feedback from each session will be analyzed to understand how individuals of the science, technology, engineering, and mathematics field, STEM, compared to how non-STEM individuals react to these sessions. This study investigates the effectiveness of difficult dialogue sessions at implementing social change on campus. Through further research and data analysis, we hope to gain insight into ways difficult dialogue sessions are effective to further implement and improve race relations across campuses.

**Title: The Rhetoric of Disorder: OCD in Metaphor**

*Author(s): Adrin Martin*

*Primary URS Faculty Advisor: Sara DiCaglio, Ph.D.*

**Abstract:**

Due to varying levels of healthcare access throughout the world, self-help books are one of the most accessible and pervasive means of mental health treatment today. While these texts thrive, in part, due to their convenience and affordability, many individuals rely on workbooks as a form of private aid when afflicted by disorders that elicit embarrassment and shame. Because Obsessive-Compulsive Disorder is an underdiagnosed and underserved ailment, the OCD sufferer may seem like an ideal candidate to benefit from treatment workbooks. However, using text as the first step in coming to terms with mental illness can have some notable, if under-acknowledged, consequences. In this presentation, I discuss the impact of text on the OCD sufferer by dissecting Hershfield and Corboy's "The Spotlight" metaphor in *The Mindfulness Workbook for OCD*, as well as why I think OCD is an ideal case study for rhetorical phenomena in the field of mental health texts. I then use the findings to discuss some interesting rhetorical implications before concluding with some key takeaways. Moreover, I hope to emphasize the wider possibility that *all* mental health sufferers may be using text to assign a face to their ailments, and that such a phenomenon may bring unforeseen harm.

**Title: The Search for an Atheist Fantasy: Introducing *Troubled Pilgrimage to the Grotto***

*Author(s): Sebastian Torruella Alvarado*

*Primary URS Faculty Advisor: Jason M. Harris Ph. D.*

**Abstract:**

Since the inception of literature, religion has been a dominating thematic force in the field and with it-conversion; however, a survey into the related literature reveals such popularity stands counter to a lack of variety as the reverse narrative, deconversion remains under examined. Deconversion is not a new spiritual

path but only recently has it been considered seriously as a valid endpoint rather than a hurdle to overcome. This is especially true in fantasy literature which, for reasons central to the genre's elements and development, is particularly sympathetic to texts which favor spirituality and religiosity. However, as similar methods which defend belief can be employed to incite unbelief, true parallel texts can be produced, if care is taken with respect to the aspects of the genre which implicitly support belief over unbelief. In recognition of and response to the disparity between positive and negative depictions of unbelief, *Troubled Pilgrimage to the Grotto* presents a deconversion story in which loss of religious adherence is recognized as a valid spiritual path. It addresses in narrative form theological problems such as religious pluralism, historical inaccuracy of religious mythology, as well as further developing issues such as the Euthyphro dilemma, the problem of evil, etc. By presenting these arguments in a narrative sense in their extended form but having them ultimately culminate in unbelief, a balanced presentation of ideas can be achieved while still furthering the broader agenda of filling the niche of unbelief in theological fiction. This important step may help further interest and study in an underdeveloped field.

**Title: The Socio-Economic Implications of Automation: NIT and UBI as Alternative Policy Responses**

*Author(s): Dylan Bohn*

*Primary URS Faculty Advisor: Dr. Alexander Pacek*

**Abstract:**

This paper will be written to address the economic and social implications of imminent automation and operate under the assumption that automation will cause catastrophic unemployment rates. Therefore, there is a search for an economic policy that would help alleviate subsequent unemployment externalities such as higher suicide rates and a shrinking population. Two policies, the Negative Income Tax and a Universal Basic Income, have risen to prominence as ways of reducing poverty. A Negative Income Tax is a modification of the tax bracket first popularized by Milton Friedman and gives those under the poverty line a rising incentive to work more hours while providing a bit of spare income. A Universal Basic Income is a policy that ensures everyone in a set population receives a financial benefit of equal degree in a given period, a proposal that has been tossed around by scholars as far back as Sir Thomas More and his *Utopia*. Both are variants of the concept of a Basic Income Guarantee, a policy in which those with financial insecurity have the assurance of a living income. In this paper, I will examine both policies in reference to their effects on the unemployed and underemployed, in hopes that such results will show us what policy will perform best in an increasingly automated world. Based on data initially collected and my preemptive literature review, I expect that a Negative Income Tax will show better results in the short term, while a Universal Basic Income will be a solution for a more extreme economy. It is my hope that these findings will help prepare policymakers and scholars of political economy as the global community steps forward into a world dominated by automation.

**Title: The Texas Cesium Iodide Array for Astrophysical Measurements**

*Author(s): Logan Jeffery*

*Primary URS Faculty Advisor: Dr. Grigory Rogachev*

**Abstract:**

A novel cesium iodide detector array has been designed for use at the Cyclotron Institute at Texas A&M University (TAMU). Officially named "The Texas Cesium Iodide Array for Astrophysical Measurements," or TexCAAM, its design is intended for use in sub-coulomb, alpha-transfer astrophysical experimentation. Specifically, TexCAAM will be used to collect data in experiments that offer potential solutions to the Cosmological Lithium Discrepancy, as well as experimental observations of processes that could aid in the formulation of zero-metallicity, population-III stars in the early Universe. TexCAAM consists of 32 tellurium-doped, cesium iodide scintillation detectors that are arranged to surround a mounted target. Its design has high geometric efficiency, possessing a solid angle coverage of ~90%. Rare isotope beams are available at the TAMU Cyclotron Institute using the momentum achromat recoil separator. TexCAAM can be used to fully characterize the reactions between a beam and a target material. TexCAAMs construction is complete, and it has undergone energy calibrations for each of its constituent detectors. It has already been used successfully in several nuclear astrophysical experiments. The efficiency calibration for the array is ongoing, and GEANT4 simulations are expected to be used in this process for gamma energies dominated by photon pair-production. TexCAAMs design and calibrations will be presented in this presentation.

**Title: The Whole as The Part: An Analysis on the Arrangement of Permanent Supportive Housing Neighborhoods**

*Author(s): Maggie Martin*

*Primary URS Faculty Advisor: Prof. James Michael Tate*

**Abstract:**

There is evidence of a lack of architectural design in the arrangement of permanent supportive housing (PSH) neighborhoods. Many promote or even require community engagement and interaction, which makes the configuration of the community vital. Though there is no question that PSH neighborhoods have been beneficial, the primary question lies in what steps can be taken to improve the overall arrangement of the communities. Research began with an in-depth analysis on the arrangement of four diverse PSH communities. Commonalities were identified through each aspect of the projects, both good and bad. Qualities were then displayed in a series of analytical drawings at each scale of the projects from city to individual unit. Additionally, four analogical drawings were created to playfully draw a line from site plans to the mundane arrangement of objects within the home. While researching, it became clear that though motivations in the designs are pure, they can fundamentally miss the mark and result in inefficient designs for the city and the residents of the communities. This led to an effort to develop accessible and understandable information pertaining to crucial aspects in designing a successful housing community, a toolkit was developed to fulfill this purpose. The lack of architectural quality in PSH neighborhoods is largely due to the lack of design in arrangement, but with the consideration of the elements and strategies proposed, these communities can be designed as both programmatic and aesthetic. The goal of this research is not to prove one model better than another, but rather to uncover general elements of design which should be considered when arranging any supportive housing model.

**Title: The of the ventral hippocampus on contextual learning for two way signaled active avoidance**

*Author(s): Sarah Perry*

*Primary URS Faculty Advisor: Stephen Maren, Ph.D.*

**Abstract:**

A hallmark coping mechanism of post-traumatic stress disorder (PTSD) is avoidance, which can be defined as behaving in a way that decreases the likelihood of interacting with a perceived threatening stimulus. While avoidance is adaptive in dangerous situations, it becomes maladaptive if it continues in a safe environment (or more broadly, context), so it is important to research if avoidance is context dependent. Since the hippocampus is responsible for animals pairing important events to the context that they were in, it would likely be responsible for contextual regulation of avoidance. The ventral hippocampus is specifically of interest as it is shown to play a key role in modulating behavior in anxiogenic contexts, such as passive avoidance of a potential threat. Seventy-five Sprague Dawley rats were obtained for two way signaled active avoidance (SAA) in which the rat must completely cross to the other side of the conditioning box during a tone CS to prevent a footshock US and terminate the CS. In the first experiment, the rats were trained in one of two contexts, Context A or Context B, for either 4 or 8 days and then tested under extinction conditions (no termination of the tone and no shock) in both contexts in a counterbalanced order. Rats tested in the same context as they were trained in showed similar levels of avoidance behavior, but rats that were tested in a different context showed a statistically significant decrement in avoidance responding, thus displaying a context shift deficit. In a second experiment, the rats were trained for 4 days in the two-way SAA. To test if ventral hippocampus is responsible for the behavioral effect, the ventral hippocampus was inactivated with muscimol or injected with vehicle as a control during the testing sessions. As shown previously, rats given vehicle injections showed the same context shift deficit when tested in a novel context. However, rats given muscimol injections had similar levels of avoidance responses in both the novel and original contexts for testing, exemplifying that the ventral hippocampus mediates the context dependence of avoidance. These results exemplify that ventral hippocampus is important for constricting avoidance to the training context and improper functioning of this brain area could lead to context dysregulation of avoidance in conditions like PTSD.

**Title: The study of tissue heterogeneity and classification using ai techniques**

*Author(s): Jude Aloudeh, Mohamed Zeid*

*Primary URS Faculty Advisor: Jude Aloudeh*

**Abstract:**

The idea behind our project is to design an algorithm that utilizes artificial intelligence to detect tissue heterogeneity in patients without the need to carry out an invasive biopsy. We aim to make the cancer prognosis process based solely on the study of the scanned medical images such as MRI or CT. The algorithm will be written in Python and will utilize large data sets of radiomics biomarkers extracted from medical images of different modalities through a software called LIFEx. Radiomics biomarkers are huge amounts of quantitative features extracted from medical images that characterize tumor phenotypes like texture and shape. There are two objectives that we want our algorithm to achieve: first is to classify the cancer stage and second is to diagnose cancerous tumours from the medical images. In this project, we will focus on cervix cancer as it is of great interest to our collaborators who are providing us with private data. Another benefit to our algorithm is that it will offer a noninvasive method for cancer diagnosis and will hence bypass biopsies as they are associated with many additional health risks and costs. This project will contribute to changing the way doctors diagnose cancer and make it a more efficient process using our robust, reliable detection of tissue heterogeneity.

**Title: Thermoelectric Power Harvesting for Biomedical Implants**

*Author(s): Seth Petrosky, Thomas Janes*

*Primary URS Faculty Advisor: Aydin Karsilayan, Ph.D.*

*Co-URS Faculty Advisor: Jose Silva-Martinez, Ph.D.*

**Abstract:**

The modern healthcare industry relies on the use of implantable monitoring devices to obtain potentially life-saving data. This has led to the necessity for small, long-lasting batteries to be used in these devices. In order to replace the battery, the patient must undergo invasive surgery. This surgery can be costly and physically strenuous for the patient; thus, there is a desire to minimize the frequency of battery replacement. The goal of this research is to develop an integrated circuit capable of being deployed within implantable medical devices to extend battery lifetimes. Many devices are implanted just below the skin of a patient. Furthermore, since there are natural temperature differences between the inside of the body and the inner layer of the skin, there are temperature gradients that develop across these implanted devices. Using the well-known physical principle called the Seebeck effect, temperature gradients can be exploited to produce electrical power with the help of a specialized device called a thermoelectric generator. This harvested energy can be used in place of the battery to supply power to the implanted device with the help of an integrated circuit. Structures present in this circuit include a switching regulator with a feedback controller, an oscillator and a digital logic block. Our presentation will highlight the design procedure, optimization techniques and performance of our integrated circuit solution and the subsystems within.

**Title: These Uncertain Times**

*Author(s): Abby Forrest*

*Primary URS Faculty Advisor: Lowell M. White, Ph. D.*

**Abstract:**

This work is a creative thesis and focuses primarily on the reactions people have when in times of crisis, as well as introspection on whether or not it would be the moral decision to change things in the past, if it were possible. The creative works portion of this thesis is the beginning of a science fiction novel, which takes place in an alternate timeline to our own where the Cold War escalated in the early 1980s. The plot follows two different characters in different time periods: one of the main characters' story is set in the year 2024 and follows her as she attempts to discover how to change the past. The second storyline takes place in the early 1980s, and follows another main character as he makes his way through a world which has suddenly been plunged into chaos. Overall, my research focused primarily on science fiction works of a similar genre, as well as research into topics that are relevant to the themes of the story.

**Title: Third Party Victims of Injustice: Families of Defendants**

*Author(s): Sarah Gaucher*

*Primary URS Faculty Advisor: Linda Radzik, Ph.D.*

**Abstract:**

There is no question that crime has immense ripple effects on communities all over the United States. Direct victims of crimes suffer immense consequences and often times are never able to seek justice for the wrongdoings against them. However, in the State of Texas, Victim Compensation Programs (VCP) allow for direct victims to receive aid for the losses and trauma they have experienced. This aid is not offered to other victims that are not directly involved in the specific crime. Specifically, when a defendant is arrested and subsequently incarcerated, the people in their immediate family often experience ripple effects of punishment even though they are innocent of any wrongdoing. This is an injustice. As my research continues it is more and more obvious that direct victims and third-party victims like the families of defendants experience similar versions of injustice. Financial strains and emotional trauma are just some examples. This leads to further research to be done on why the criminal justice system has seemed to leave this side of injustice out and who is responsible in rectifying this injustice. If we look at VCPs, they are not available to third party victims in Texas. There are many hypothesized reasons for this. Additionally, it is the state punishing the defendant so an argument can be made for the state being responsible for rectifying the injustice that third parties experience. But is the state obligated to provide VCPs or is there a more preventative approach that is possible? This leads to my conclusion being that the state can prevent injustice of third parties by reducing the scope of punishment on the defendant. Scope of punishment in the criminal justice system is responsible for the degree of injustice third parties experience.

**Title: Towards Enhanced Diagnosis of Diseases Using Statistical Analysis of Genomic Copy Number Data.**

*Author(s): Isha Abbasi, Nadin Mohamed, Weam Mazen, Asra Saeed, Rawan Abdulgadir*

*Primary URS Faculty Advisor: Dr. Mohammed Nounou*

**Abstract:**

Genomic copy number data are a rich source of information about the biological systems they are collected from. They can be used for the diagnoses of various diseases by identifying the locations and extent of aberrations in DNA sequences. However, copy number data are often contaminated with measurement noise which drastically affects the quality and usefulness of the data. The objective of this project is to apply some of the statistical filtering and fault detection techniques to improve the accuracy of diagnosis of diseases by enhancing the accuracy of determining the locations of such aberrations. Some of these techniques include multiscale wavelet-based filtering and hypothesis testing based fault detection. The filtering techniques include Mean Filtering (MF), Exponentially Weighted Moving Average (EWMA), Standard Multiscale Filtering (SMF) and Boundary Corrected Translation Invariant filtering (BCTI). The fault detection techniques include the Shewhart chart, EWMA and Generalized Likelihood Ratio (GLR). The performance of these techniques is illustrated using Monte Carlo simulations and through their application on real copy number data. Based on the Monte Carlo simulations, the non-linear filtering techniques performed better than the linear techniques, with BCTI performing with the least error. As for the fault detection techniques, GLR had the lowest missed detection rate at a fixed false alarm rate.

**Title: Understanding the effects of Soil Moisture Dynamics in the Carrizo-Wilcox Aquifer**

*Author(s): Chelsea Parada*

*Primary URS Faculty Advisor: Bradford Wilcox, Ph.D*

**Abstract:**

There has been tremendous advancement in our understanding of how woody plant encroachment alters water and energy budgets, but research is limited for oak savannahs. In Texas, the Post Oak Savannah ecoregion has been heavily altered since the 1850s as development has caused woody plant encroachment to take hold. This project questions how this change has impacted groundwater recharge, with a focus on soil moisture dynamics in a post oak savannah ecoregion overlying the Carrizo-Wilcox Aquifer. A site was selected that matched these criteria and tubes were installed at different depths and points along the property. Each tube was designated as either a pasture or wooded location. Soil moisture data collected from a Neutron

Moisture Meter probe in both classifications were taken at 20cm intervals for up to 10ft into the soil. This was done to compare, find, and analyze the soil dynamics between the two classifications of land type. The overall goal of my work in the Carrizo-Wilcox recharge zone is to determine the extent to which recharge to the aquifer may have been enhanced by vegetation manipulation from this encroachment and land-use change. I hypothesize that woody encroached sites maintain higher soil moisture when compared to open pastureland that results from vegetation manipulation. The findings of this research can also be used to calibrate hydrologic models for estimating recharge.

**Title: Using Engineering to Create an Adaptive Self-Feeding System for Patients with Upper Body Disabilities**

*Author(s): Zeina Barghouti, Hourig Ohanian, Reem Elhadi, Almotazbelah Eledrisi, Marwan Badreldin*

*Primary URS Faculty Advisor: Michael Schuller, Ph.D.*

*Co-URS Faculty Advisor: Talia Collier, MD*

**Abstract:**

The aim of this research project is to provide a self-feeding manipulator system to accommodate for patients with upper-body motor disabilities. The purpose of the device is to allow patients to rely less on their caregiver during a meal. The assistance should be achieved safely while feeding the patient at home or in a public setting. The target cost is QR4000 with nine months to develop a prototype. Similar devices on the market share a common need: assist people with disabilities in feeding themselves. The disadvantage to all the existing products is their cost, ranging between \$4000-\$8000. In addition, they are inaccessible to patients in Qatar due to their production and overseas market. Engineering methods are to be used to create a device that is more versatile and accessible. This thesis discusses the steps created to build the manipulator arm. The arm is designed with four degrees of freedom, the motors selected to actuate the joints were Servo Motors. The robotic arm is to work automatically using a feedback control system. Some parts of the device require the use of 3D printing, which will be accessible in the TAMUQ building. In addition, some parts will be bought based on device requirements. The device consists of four main components. Firstly, the base which encases all the components. Next, a plate where the food will be placed, quarterly divided, has the ability to rotate. The main component is the robotic arm along with a spoon attached. The arm is engineered to accomplish self-feeding tasks by providing a lifting force from a bowl to the patient's mouth. Finally, the user-interface allows easy communication between the user and the device. We aim to have the device ready to test by April 2021 and allow patients from Sidra Hospital to test the device.

**Title: Using Linguistic Analysis To Detect Anxiety in Public Speaking**

*Author(s): Sacheth Swaminathan*

*Primary URS Faculty Advisor: Theodora Chaspari*

**Abstract:**

Public speaking is a skill that helps virtually everyone in their day-to-day life. Being able to identify public anxiety in speech is the first step to developing this skill. There has been a lot of work on methods of detecting anxiety in speech ranging from video recordings to audio recordings to find indicators of anxiety. Our aim is to look into a new method of helping with detecting anxiety by analyzing transcriptions in order to predict anxiety based on the words that were used in speeches. We utilize GloVe word vectors in order to represent speech in a numerical sense. Then take this data and create a model to predict anxiety. We explore different model architecture ranging from traditional machine learning models to more sophisticated deep learning models. After analyzing the performance and accuracy of each model, we determine which would be the best in predicting anxiety scores based on a transcribed speech. We also explore the differences in including filler words and keeping them out. The best model will be used alongside other methods and models in order to optimize the best possible method to detect anxiety in a public speech. This enables a speaker to see how their word choice and speech structure impacts the way they get their point across.

**Title: Using Virtual Reality as an Educational Tool for Dance**

*Author(s): Kamryn Massey, Julie Choi*

*Primary URS Faculty Advisor: Jinsil Seo, Ph.D*

**Abstract:**

In the current climate of COVID-19, providing high-quality education for students is difficult, particularly regarding fields that are traditionally reliant on in-person teaching interactions. Studies such as sports or dance rely on mentors being able to demonstrate motions and critique students when they emulate the lessons. As the pandemic makes it either limited or impossible to learn physical skills in a traditional classroom setting, we aim to resolve this problem by providing a virtual setting for students to learn in with appropriate resources. This research project aims to provide Virtual Reality-based educational software that can provide dance students with simulated 360 views of fundamental movements. The software allows students to scrub through movements, rotate the virtual instructor, choose from several different dance options, and change the speed of the currently viewed dance movement. Motion capture was used to provide the initial data for fundamental dance positions, to portray these movements accurately. A "muscle mode" is also provided in the interface, highlighting key muscle groups used in specific dance positions and providing information about how they are being used and how to train such muscles to better enhance their ability. Our process for producing this program was creating a very simplified version, where the environment was composed of boxes and the teaching model was a simple cube. This allowed us to make sure all the technical aspects of the interactions were completely functioning before beginning to fill out the environment with the final assets. Our environment also changed throughout the designing process as we worked through what makes a dance studio feel like an inviting and positive space to be learning a new skill. This iterative process became the core of our research as we explored how a person would be the most successful when learning in a virtual environment.

**Title: Using write buffers in Systolic Array architectures to mitigate the number of memory access produced by Row Stationary dataflows**

*Author(s): Daniel Peralta Velazquez*

*Primary URS Faculty Advisor: Paul V. Gratz, Ph.D*

*Co-URS Faculty Advisor: Kevin Nowka, Ph.D*

**Abstract:**

New applications of Deep Neural Networks are being designed such as fraud detection, short term weather precipitation forecasts, and cancer prognosis prediction. Nonetheless, their respective models are getting more complex with an increasing number of depth layers. These models require millions of computations that conventional CPU and GPU architectures will take a significant amount of computational time. The data distribution of these models is well known; they mostly consist of dot product operations between inputs and filters. Applications such as self-driving cars required fast response time and accurate predictions. Current research introduces accelerator architectures based on 2D systolic arrays as they provide high efficiency in performing multiplication and accumulation operations. Computational and power cost define performance, memory accesses attribute the highest cost to current architecture models. In order to enhance the performance of DNN accelerators, parallelism is extracted by breaking convolution into partial computations at the expense of segmenting output memory accesses. This thesis explores the implementation of an accumulator microarchitecture component based on column pipe-lined adder trees with the purpose of collecting and aggregating output computed values based on destination address. The results of this work showed a 3.3x and 2.15x speedup for Tiny-YOLO and AlexNet CNN using a 32x64 Systolic Array. Through the reduction of computed values, developers will be able to explore novel data mappings to extract parallelism based on data locality.



**Title: Video Games, Colonialism, and Theater: the Effects of Limited Freedom in Emergent Narratives**

*Author(s): Caroline Kibby, Gianluca Percovich*

*Primary URS Faculty Advisor: Daniil Leiderman, Ph.D.*

**Abstract:**

Video game studies are a field rapidly growing in popularity and in depth of analysis. This paper intends to examine certain subsets of video games by examining them through postcolonialist and Brechtian lenses, among others. The first section discusses “endless” games (such as Animal Crossing, Minecraft, and The Sims), the ultimate goal of which is for the player to have fun. We find that these games encourage and often require the player to engage in behaviors that colonize the game’s virtual world in pursuit of this fun. These games purport to give the player limitless freedom and tools to express themselves creatively, but in the end the player’s only choice is to what extent they appropriate the world around them for their use. The second section examines narrative games, like The Stanley Parable and those in the Mass Effect series, and finds that these games create experiences similar to those in theater, particularly Brechtian theater, but these experiences are unique to video games and are irreplicable in other media. These games allow the player to behave as the audience, actors, director, and playwright of a digital theatrical production, but the player is always limited in their choices to those paths of action which the game’s designers lay out for them. Ultimately, this thesis examines the relationship between freedom and limitation within a video game’s systems, and concludes that while games allow players to self-express and creatively problem solve, games are a fundamentally constructed and directed experience.

**Title: Viral production and its role on prokaryotic communities within anoxic subsurface ecosystems**

*Author(s): Madeleine Thompson*

*Primary URS Faculty Advisor: Dr. Jessica Labonté*

**Abstract:**

Sediment covers nearly 70% of our planet, and recent research showed that microbial communities can survive more than 2.5 km below the seafloor. While the meiofauna normally follows oxygenation gradients at the surface of ocean sediment, microbes can use a wide range of electron donors other than oxygen, including sulfur, nitrogen, and carbon, for energy production and respiration. My goal was To characterize virus–host interactions by measuring virus-induced microbial mortality rates in anoxic sediment from Blackwood Sinkhole in the Bahamas. The following hypothesis was tested: Virus-induced microbial mortality rates will be higher when the nutrients concentrations or Carbon availability are high. I used subsamples from the sediment core from an anoxic marine basin (Blackwood Sinkhole, Bahamas) to conduct viral production experiments (where virus-induced microbial mortality rates was determined). The nutrients found in most abundance was ammonia . When the nutrient concentrations were at their highest, the viral production stayed low. However, when the ammonia increased at one depth, the viral production and DOC increased. The viral production increased between 0 and 3 hours, which led to a higher microbial mortality rate. The DOC release increased the viral production increased, and vice versa. The DON followed a similar trend. The virus-induced microbial mortality inversely correlated with the concentration of available electron acceptors, which are drivers of anoxic microbial respiration. The dissolved organic carbon and nitrogen were released through viral lysis, suggesting viral lysis plays an important role in electron availability, nutrient recycling, and microbial mortality.

**Title: What's in a Name? Forenames as a Predictor of Psychopathological Personality Traits**

*Author(s): Noah Reed*

*Primary URS Faculty Advisor: Dr. Gerianne M. Alexander*

**Abstract:**

Forenames are commonly recognized as labels used to identify or distinguish ourselves from others and signal varying levels of behavioral traits within a gender group, with some gender-specific forenames appearing as more prototypical than others. Forenames have been discovered to influence how individuals are perceived by others and even how we perceive ourselves. Forenames have also been found to predict one's facial appearance and behave as social tags that aid in the categorization of age and race. Therefore, the proposed study expands upon previous forename literature by exploring the "self-fulfilling prophecy" effect between forenames and personality traits associated with psychopathology. To examine this effect, data from 75

individuals who were administered the Personality Assessment Inventory (PAI) was collected and the forenames of each individual were distributed to participants recruited through a student subject pool. Participants were instructed to "stereotype" a randomized subset of the 75 forenames according to their perceived gender, race, and age. Following the collection of these ratings, the predicted associations between perceptions of personality traits and forenames were examined. Perceived gender and age of forenames were significant predictors of traits such as anxiety, aggression, antisocial features, and stress; however, they were not significant predictors of traits like suicidality, depression and schizophrenia. This suggests that, overall, forename stereotypes are consistent with gender differences in disorder-relevant personality traits. Potential explanations for the lack of significance in the aforementioned traits are discussed.

**Title: Wind in Film: Representations of Wind Energy in the On-screen Anthropocene**

*Author(s): Lauren Curtis*

*Primary URS Faculty Advisor: Carmela Garritano, Ph.D.*

*Co-URS Faculty Advisor: Maddalena A. Cerrato, Ph.D.*

**Abstract:**

At a time of impending climate crisis and rising fossil fuel consumption, there is a growing need for alternative energy transition. Under the emerging discipline of energy humanities, scholars acknowledge that today's energy problems are a matter of ethics, habits, values, and cultural practices. Although most of this scholarship analyzes the permeance of oil in society, few scholars have investigated the implications of alternative energy as expressed in art forms like film and literature. This project uncovers the significance behind film portrayals of wind energy as a way of expanding knowledge of our relationship to alternative energy and its viability through the theoretical frame of object-oriented ontology. The thesis argues that the feature films *The Boy Who Harnessed the Wind* (2019), *Le Vent Tourne* (2018), and *Turbines* (2019) navigate the role of wind energy in a way that reimagines interrelations between human and nonhuman actors through cinematic techniques in storytelling. These film narratives challenge the traditional understanding of the humans vs. nature binary by allowing nonhuman components of wind energy a degree of agency through the lens of object-oriented ontology. Each film portrays on-screen "energy anxiety" that negatively affects a character's well-being based on fears of energetic instability, heightened by the implementation of wind. Overall, these representations communicate attitudes towards wind energy that challenge traditional belief in its potential as a sustainable alternative energy source.

**Title: Zooxanthellae Counts in Bleached Coral**

*Author(s): James Scolley*

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*Co-URS Faculty Advisor: Katie St. Clair*

*Co-URS Faculty Advisor: James Franklin Scolley*

**Abstract:**

This study treated pulsing xenia coral to increased temperatures to determine the concentration of zooxanthellae in bleached and nonbleached samples. Samples were taken before and after bleaching events then the zooxanthellae was extracted and quantified. The three frags yielded the same result of having lost 80% of their zooxanthellae concentrations. The massive loss of zooxanthellae caused the death of the coral and a better understanding to what is happening. We can use this information to further question how this can be stopped by looking at different concentration loss is and determining their survivability from it.