The UTPB Journal of Undergraduate Research

Established 2018

Volume 4

September 2022

Pollen of Polygonaceae from Palo Duro Canyon State Park – the Grand Canyon of Texas. Courtesy of Andrea Soteldo-Valerio and Mohamed Zobaa, Department of Geosciences, UT-Permian Basin.

Quantitative Confocal Microscopy Analysis of Mitophagy Flux Using the mCherry-GFP-fis 1 Plasmid Construct

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Abstract

Mitochondria are important for energy production and calcium ion regulation in eukaryotic cells. Dysfunction mitochondria, however, produce harmful reactive oxidative species (ROS) and can induce the programed cell death pathway known as apoptosis. Cells regulate these dangers by isolating dysfunctional mitochondria and digesting them within the lysosome, an acidic organelle. This sequestering and digestion process is referred to as mitophagy. Misregulation of mitophagy has been implicated in multiple neurodegenerative diseases, including ALS and Parkinson's disease, but the molecular processes are still not fully understood. Recently, the Presenilin-1 associated protein (PSAP) has shown to be a pro-apoptotic protein localized to the outer membrane of the mitochondria. Further, preliminary research has shown that PSAP may play a role in mitophagy. This project is designed to measure the changes in mitophagy after the knockout of the PSAP gene using cultured cell models. We used CRISPR/Cas9 technology to eliminate the PSAP gene in NSC34 cells, a motor-neuron-like cell line, to create a PSAP knockout (PSAP-/-) cell model. To analyze the mitophagy process, we transduced the PSAP-/- cell line with the DNA construct mCherry-GFP-fis1. This construct bears two fluorescent markers (Green Fluorescent Protein, or GFP, and the red mCherry marker) preceded by a mitochondrial targeting sequence, localizing the fluorescent reporter proteins to the mitochondria. This fluorescent construct is sensitive to the shift in pH associated with lysosomal degradation, allowing us to visualize and quantify mitophagy flux in living cells using fluorescent confocal microscopy.

Lysophosphatidic Acid (LPA) Induces Smooth Muscle Cell (SMC) Proliferation, Migration, and Protein Expression

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Abstract

Atherosclerosis is a common form of cardiovascular disease that is a leading cause of death in the United States. Smooth muscle cell migration and proliferation are important contributors in the formation of lesions in the progression of atherosclerosis. High-fat diet elevates levels of lysophosphatidic acid (LPA) in rabbit and mouse plasma/serum, which promotes atherosclerosis development. We conducted experiments to explore the effects of LPA on vascular smooth muscle cell (SMC) proliferation, migration, and protein expression to better understand the molecular mechanism of cardiovascular disease, using mammalian cell culture models. We determined the relationship of LPA with Cyr61, a matricellular protein that highly induces smooth muscle cell migration and promotes vascular lesion growth. We measured SMC proliferation and determined SMC migration in response to LPA stimulation in a Boyden chamber assay. Furthermore, we compared the influences of growth factors (fetal bovine serum) and LPA on SMC migration. Our research demonstrated that LPA induces proliferation and migration of SMCs and markedly induces matricellular protein Cyr61 expression. This suggests that LPA, contributes to the development of atherosclerosis via the induction of matricellular protein Cyr61, which in turn, promotes vascular SMC migration.

The Effects of Toxic Substances on the Formation of Biofilms by Marine Bacteria

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Abstract

Biofilms are protective matrices made by some bacteria when they attach to a surface and begin accumulating, enabling them to survive in hostile environments. Biofilms formed by marine microorganisms negatively impact the ballast tanks used by the Navy in many of their ships by causing corrosion and fouling, which leads to increased maintenance costs and fuel consumption. The purpose of this research was to test different toxic substances and their effect on biofilm formation. We hypothesized that bacteria should increase biofilm formation in the presence of sublethal concentrations of the compounds to survive more effectively. The marine bacterial strain SD8 was tested using bleach, which contains the active ingredient sodium hypochlorite. The bacteria were allowed to grow in marine broth and were assayed to determine the inhibitory concentrations of sodium hypochlorite. Based on absorbance readings at a wavelength of 600 nm, which detects bacterial growth, the inhibitory concentration of sodium hypochlorite was 0.033%. To determine the effect of sodium hypochlorite on biofilm formation, the bacteria were grown in wells in microtiter plates in the presence of various concentrations of sodium hypochlorite for 2 days at 26o C. The bacteria were removed from the plate, but their biofilm, which remains adhered to the wells, was stained with crystal violet, and a microtiter plate reader was used to measure their absorbance at 550 nm of the solubilized crystal violet. We continued to determine the effect of sodium hypochlorite on biofilm formation.

Public Database of West Texas Pollen Species

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Abstract

Stemming from the lack of easily accessible, publicly available online information about pollen species of flowering plants endemic to West Texas, we proposed to develop a public database that stores a comprehensive record of pollen species collected from fieldwork in West Texas (e.g., Big Bend National Park and Palo Duro Canyon State Park – the Grand Canyon of Texas). The project consisted of three functional requirements: a database to hold a library catalog of the pollen species, an administrative interface that would allow for adding and changing the data, and a User Interface (UI) to expose this data to the user. Databases efficiently work with large amounts of data and provide access to standardized information that can be organized and updated to stay current. Data are presented in the form of photographs, videos, and models. The objective is to ensure the system leads to an improved user experience that will increase public engagement and understanding of pollen species. If successful, this database will serve as a way for geologists, scholars and/or citizen scientists all over the world to access credible information easily online.

Statistical Evaluation of Wastewater and Brackish Water in the Permian Basin, Texas

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Abstract

The objective of this research was to evaluate the Total Dissolved Solids (TDS) in wastewater within the Permian Basin and determine the environmental impact it will have if left untreated. The focus of this research was on the TDS of wastewater, historical treatment, and the possible reclamation of wastewater for future use, such as reintroduction into a natural habitat, irrigation and/or cooling facilities or factories. The objective of this research was to show that there are organizations that express interest in wastewater salvage, saving future freshwater usage. This research also expressed the hazards and damages that untreated wastewater can cause to the natural habitat and to the environment. The results of this research assisted in increasing awareness and communicating the importance of recycling wastewater to acceptable standards. This research also determined how destructive it will be to the environment and natural habitat if left untreated. This research could also be utilized to show future workforce and leaders the process, methods, and progression of the struggles that were endured to ensure fresh water for the future.

H2S Gas Sensing via Autonomous Robots in Oil Field Application

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Abstract

Hydrogen sulfide (H2S) is a colorless, flammable, and eminently toxic gas that is extremely dangerous at higher concentrations. Every year, various workers, mainly in the oil & gas industries, lose their lives due to H2S exposure. Safety measures such as fixed H2S gas monitors, personal H2S monitors, and alarm horns act as the first line of defense in case of gas leaks in the oil and gas industries. Despite these engineering controls, many fatalities occur due to H2S exposure. There is a need to provide better solutions for H2S detection and reporting. This work addresses a modern and innovative way to solve H2S sensing safety concerns. An autonomous robot with H2S gas sensing capabilities and GPS would maneuver to the site of the H2S leak, monitor and measure the H2S gas concentration, and report the measurements. We provided detailed design of an autonomous robotic-based system.

Automatic Power Factor Correction System

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Abstract

According to the U.S Department of Energy, a low power factor only allows 70% of the current provided by the electrical utility to be used to produce useful work. Standards are established to maintain a healthy power grid, in which the power factor is a variable of concern because the efficiency and capacity of the system depends on it. A power factor less than 0.95 increases power losses and voltage drop across the transmission lines. This requires utility companies to apply penalties to customers due to the increase of cost in power generation and transmission, and results in possible damage or failure on electrical equipment. There are different methods used to maintain a healthy power factor. Automatic Power Factor Correction (APFC) is a potential solution for modern power systems. The objective of this project was to design, prototype and test an APFC system that would automatically maintain a standard power factor by measuring and deciding whether a capacitor bank is needed to compensate the reactive power on the system. A detailed design is presented.

Open Loop Buck Converter and Microgrid HIL Real-Time Simulation

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Abstract

Due to the environmental effects of conventional energy sources, renewable energy sources such as solar energy have gained more attention. Electric cars are also gaining popularity among the masses, being environment-friendly and having lower long-term costs. DC-DC power electronics converters are an essential item in solar-powered appliances and electric cars. In this research project, we focused on creating a DC-to-DC Buck Converter by developing a design and simulation of an open-loop converter in MATLAB R2020a/Simulink and the calculations of various parameters such as fixed duty cycle, efficiency, output voltage, and power. A microgrid is a small-scale electric power distribution network. It is composed of various distributed electric power sources connected to the main bus through power electronics converters supplying various distributed loads. In this work, a microgrid model is simulated in consultation with OPAL-RT, which is connected to a strong electric network. Hardware-in-the-loop (HIL) simulation is a type of real-time simulation. The microgrid is controlled by a dashboard on RT-Lab, allowing the user to manage different tasks and variables on the system.

A Potential Alcohol Diffusion Model for Each Composite Layer of the Skin by Using Ordinary Differential Equations (ODE)

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Abstract

Diffusion is the chemical phenomenon of material science that deals with the net movement of a substance from a region of higher concentration to a region of lower concentration. In this research, we built a mathematical model for evaluating the diffusion of alcohol across different layers of the skin. The transdermal alcohol concentration, which comes through the skin's pores, is determined from the blood alcohol content (BAC) with the help of this model. The differential equations for each layer of the skin were solved to evaluate how each layer's thickness affects the diffusion of alcohol. The results were implemented graphically, and we found an inverse relationship between the thickness of the skin and the diffusion of alcohol. With this result, our next goal is to build a robust mathematical model to determine the transdermal alcohol concentrations with accuracy and reliability.

3D Printing of Complex Geometries Using Biodegradable Plant Based Polymers

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Abstract

This research interest lies at the intersection of physics, chemistry, and engineering primarily to improve current commercial grade 3D printing filament. The most important missions are to develop new materials and methods for use in a variety of applications, including seeking to understand the structure-property relationships of materials at different length scales. These obtained results were then compared to the commercial (ABS) filament. The areas of investigation are necessary not only because they address fundamental questions relating to size-dependent properties, but also because a better characterization of these properties may lead to improvements in current applications regarding plant-based filaments.

Fabrication and Characterization of TiO1-xAxO2 (A:Mo, W, Al, Fe) Photocatalyst for Water Splitting

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Abstract

The scope of this research is to study the effect of metal cation substitutions on the photocatalytic properties of TiO2. TiO2 is a well-known photocatalyst but has drawbacks like an absorption of only 5% of sunlight in the UV region and high electron-hole recombination. In this work, we fabricated metal cation substituted Tix-1AxO2 where x = 0.0625 (A: W, Fe, Mo, and Al) to study the scope of increasing visible light absorption, thereby, using more than 40% of the sunlight spectrum towards photocatalysis. We used an electrospinning method to fabricate nanofibers of different diameters ranging from 58nm to 168nm. After fabrication, these nanofibers will be characterized using SEM for morphology, SEM-EDS for elemental information, and XRD to confirm the phase of the materials. In the second phase, the test apparatus to measure the photocatalytic properties will also be installed.

Analysis and Prediction of Produced Water Data Using Machine Learning Algorithms

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Abstract

The distinguished features of machine learning (ML) based modeling provides a deep insight pertaining to the prediction of total dissolved solids (TDS) in produced water (PW). The current study investigates the predictive performance of Linear Regression (LR) model and Time Series Forecasting (TSF) for modeling yearly TDS. The USGS and CLIENT datasets were used for the models training and testing. The results were evaluated using various performance and accuracy indicators such as RMSE, MAE, and MSE. The model outcome indicated that both Linear Regression and Time Series Forecasting are reliable techniques in predicting TDS.

Synthesis of Adsorbent Clay for Removal of Dyes from Wastewater

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Abstract

Organic dye contaminants are often found in industrial wastewater. The presence of organic dyes in wastewater contributes to serious health and safety risks in the environment. Furthermore, these substances are typically recalcitrant and difficult to remove by conventional means. A clay-based adsorbent was synthesized, and its adsorption capacity was tested using methyl orange and methyl purple. Adsorption process is a very effective separation technique due to its successful removal of substances, simplicity, and overall low cost. The adsorbent will be characterized by using X-ray diffraction (XRD) and elemental composition analysis by X-ray fluorescence (XRF) spectroscopy. The absorption capacity of the organic clay is characterized by UV-vis spectroscopy. The experiment was conducted in a batch manner through a designed filter apparatus. Methyl orange and purple mixed with water were passed through a vessel containing the clay-based adsorbent, via a pneumatic pump. The expected results include adsorption rate per area per amount of adsorbent in addition to the synthetic clay characterization.

Using Electroencephalography (EEG) Measurements to Move a Computer Cursor

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Abstract

Brain waves, first recorded in humans in 1925 by Hans Berger, are complex electrical signals generated by the brain. Inexpensive brainwave detection and measurement instruments have recently been developed by a startup internet company called OpenBCI. The goal for this study was to utilize brain wave measurements, using the OpenBCI Cyton 8-channel Biosensing Board, to move the cursor across a computer screen. This application could be used to develop inexpensive tools that would allow paralyzed individuals to use a computer. We encountered issues when converting the data generated by the OpenBCI equipment to a more convenient format that can be used to move a computer cursor that we elaborated on further.

2D Metaverse Implementation for UTPB Campus

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Abstract

A metaverse is a network of virtual worlds focused on social connections. This is used to create spaces for rich user interaction mimicking the real world. As the pandemic accelerates digitalization, more and more people are getting used to conducting everyday activities online and through applications. In this project, we used the Unity game engine to create a 2D Metaverse mimicking the real UTPB campus for students and visitors that are new to the campus. In that implemented 2D Metaverse, several checkpoints which represent the buildings/landmarks are set up. An avatar is controlled by the user, which could go over all the buildings/landmarks in the metaverse. When the avatar gets to one checkpoint, interactive dialogue is triggered, and it will also show a picture and description of that checkpoint. Note that this project has great scalability, and the pattern could be used in different scenarios, such as K-12 interactive education.

Academic Validity of the Comic Book Genre

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Abstract

Academic writing follows strict rules and unrelenting procedures, which only the most sophisticated genres of writing seem to conform. However, the Comic book genre aligns flawlessly with three of the most prominent characteristics of academic writing. Comic books should be considered academic writing because the genre presents information through a string of ideas that follows a specific format, contains strong nonfictional elements, and delves deep into a particular subject. Panel by panel, Comic books present the same carefully structured sequence of ideas found in academic writing. This artistic genre frequently portrays historical or societal concepts, which aligns with academic writing's nonfictional basis. Comic books tell in-depth stories with intricate detail, satisfying academic writing's characteristic of delving deep into a particular subject. Therefore, the Comic book genre aligns with three of the most prominent and meticulous defining characteristics of academic writing, and in turn, should be considered a form of academic writing. It is time for the comic book genre, a clear form of academic writing, to find its place in the literary canon.

The Question of Morality Using Literary Realism

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Abstract

The resemblances of reality in aspects of literature has contributed to a promotion of authors using writing techniques to encourage readers to question their societies, their morals, and their highest held beliefs. The genre of Literary Realism allows authors to reach readers' minds by disassociating with setting and scenes to focus solely on the properties and duality of the characters. This genre, increased solely by the trend of historically reoccurring themes, encourages the reader to think beyond the confines of a text and into the sphere of their reality. Previous research rarely touches beyond the scope of how realistic writing conforms to aspects of morality; if at all, and lacks the comparisons needed to truly show the change that realism creates in social settings. This study takes three novels from the Western and Christian perspectives, from the eras the late 19th century to the late 20th century. The novels are John Steinbeck's *Of Mice and Men*, chosen because of the portrayal of justice using an otherwise unjust means; Leo Tolstoy's *Anna Karenina*, chosen because of its portrayal of extreme humanity; and John Irving's *Cider House Rules*, chosen because of the way it shows how situations can cross the lines between right and wrong. These novels are deciphered for themes and early periodicals are presented and cross examined with the happenings and situations of the time period. Similar to the assumption, the genre of Literary Realism maintains consistent in the presentation of common humanistic themes throughout different times. It is also found that Realism in literature entices questions of moral ambiguity even when it is discouraged. Finally, the findings of this research also indicate that due to the nature of realism causing readers to question previously held beliefs, societies are changed for the better by thinking into the gray area rather than black or white.

American Gen Z, Gender, and Romantic Relationships

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Abstract

This study discusses current female young adults' perceptions of gender roles regarding building and managing romantic relationships. Prior studies have consistently found that young women would experience more embarrassment, sweating tendency, interaction nervousness, and worse self-esteem and body-esteem than males. These studies indicate that women are more socially sensitive and emotionally influenced by social events than males, especially at a young age. For this research, through a focus group interview with four women in their early 20s, their notions of gender and gender roles in romantic relationships are discussed. This study is significant as a gender communication research providing an updated understanding of current young women's expectations of gender and relationships.

The Shadow of Local News: Media Portrayal of Black Community

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Abstract

Crime reporting throughout the news media is a very prominent way to recognize racial prejudice in society. For example, prior studies found that Black men and women committing a crime are more likely depicted with mugshots in custody. In contrast, White men and women are shown after committing a similar crime with pictures of their families or professional headshots. This study examined ten news reports by local TV stations and defined how they represented Black and White communities differently, comparing language and visual images using multimodal discourse analysis. This study empirically discussed America's current Anti-Black culture by analyzing local news crime scene reports.

Ruling Out Clinician Gender Bias in Diagnosing Borderline Personality Disorder

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Abstract

Women account for 75% of borderline personality disorder (BPD) diagnoses. Current research shows that BPD may not have this gender prevalence in the general population, that sampling bias may be a reason for it, that clinician gender bias may play a role, and that there is a chance that men are underdiagnosed. The research exploring possible clinician gender bias as an explanation offers mixed results. We hypothesized that clinician gender bias is not the reason for the gender prevalence found in BPD diagnoses. We used a case vignette that meets BPD and Post Traumatic Stress Disorder criteria and changed the pronouns between three conditions to represent a woman, man, and non-gendered patient. Clinicians were randomly assigned one vignette and asked to attribute a diagnosis to the patient. We also collected personality and demographic information to search for any covariant. Ruling out clinician gender bias allows future research to focus on the other possible explanations for the gender prevalence.

The Success and Support of Bilingual Students with Visual Impairments: A Case Study

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Abstract

Cooperation between bilingual teachers, special education teachers, and vision teachers is essential for students with limited proficiency in English and visual impairments to become fully literate and communicatively competent (Guinan, 1997). According to the Pew Research Center (2020), 75% of bilingual students possess some sort of learning or physical disability such as dyslexia, autism, ADHD, visual impairment, hearing impairment, or a physical disability. The purpose of a case study is to analyze a particular case within a real-world context. In this study, the researchers conducted a case study of two participants who are bilingual and visually impaired. Participant A was born visually impaired and he is male, Hispanic, 31 years old and has a master's degree in counseling. Participant B lost his vision at age 25 and he is also male, Hispanic, 62 years old, and has a master's degree in clinical psychology with a minor in sociology. The objective was to analyze the differences between losing the vision at an older age versus being born visually impaired, the importance of education for students with disabilities, the resources and challenges for bilingual students with visual impairments, and provide recommendations, support, or encouragement for the visually impaired.

Technology Enhanced Situated Language Learning for Second-Language Vocabulary Development

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Abstract

Situated second-language learning is a form of learning in which learning happens where it can be applied. It has been found as one of the most effective strategies for second language learning. However, due to the challenges of travelling to a country where English is the dominant language like the US or the UK, many English as a foreign language (EFL) students cannot benefit from the advantages of situated language learning. Therefore, this study tried to provide opportunities for EFL learners to virtually learn English using situated language learning strategies. Five EFL learners participated in this study. Based on the results of a pre-test, their proficiency level was basic (A1). During four weeks, they attended a one-hour class twice per week. The teacher sent a list of vocabulary to them, went to a place where those items could be applied, and had a video chat with the learners (library, park, etc.). The students were encouraged to virtually observe the context and make sentences using the words they received to describe the situations. The results of a post-test revealed that students' proficiency level improved. More importantly, interviews with the participants indicated that they were motivated to learn as they were able to use what they were learning in a real-life context.

Study of the Lithograph

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Abstract

The traditional and contemporary practices of lithography, its techniques, and its contributions to society were researched for this project. I created a body of lithographs using a lithography stone and aluminum lithography plates. Although there is an understanding of how lithographs were created with limestone in the past, techniques and unique experimentation have been done and tested by me to see different outcomes of lithographs. This led to an outcome of more than four different types of successful lithographs. This research provided an understanding of how lithographs became an important medium for mass communication during the eighteenth and nineteenth centuries and their continued success in the twenty-first century. Different ways of doing the different lithographic procedures helped this experiment and research, and has shown trial and error in both limestone and aluminum plates. This was a complete success, although not all the prints came out how they were desired to.

The Fate of Printmaking: An Investigation of the Relationship Between Digital and Traditional Mediums

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Abstract

Since the introduction of the high-speed printer and digital art in the 20th century, there has been much discussion regarding the survival of long-established mediums in printmaking. To address these doubts this study explored contemporary mediums like digital collage and illustration as well as traditional printmaking techniques like lithography and relief. The digital and traditional processes were first carried out separately so that they could be compared to one another and then were combined using a lacquer transfer technique. By the end of my research, I found that by using digital art techniques to printmaking the process became more time-efficient and precise while maintaining the tactile finish of handmade work. With these findings, it is evident that digital art is not a replacement for printmaking and should instead be considered as a tool for old processes to advance.