2023 Lucian Symposium
Poster Session Abstracts

St. Edward's University

Friday September 29, 2023

Validating Stored Procedures

Presenter: Fayzan Bhatti

Collaborated with the Pulse8 Development Team to conduct comprehensive validation and refinement of SQL 'TestEachColumn' statements across the databases within the team's repository. In cases necessitating adjustments, I leveraged Visual Studio to access the SQL files, meticulously revised the statements, staged the modifications, and synchronized any potential data committed by fellow team members. Subsequently, I initiated commits and pushed the finalized changes to the master branch.

Software Superset Proof of Concept

Presenter: Ethan Burd

Compiling the software requirements for all of my teams demos. After compiling software, compatibility was tested with all demo software and hardware.

Brush piles temporarily reduce cover of the invasive King Ranch bluestem

Presenter: Kelsey Filla

King Ranch bluestem (KR bluestem) is a non-native grass that has invaded many grasslands in central Texas, including at The Nature Conservancy's Cibolo Bluffs Preserve. This invasion reduces plant diversity, insect biomass, and bird abundance. We tested burning of brush piles as a control method. Burning a brush pile kills all vegetation within its footprint, including KR bluestem. The goal is to not only find a method of getting rid of this non-native grass, but also allow native species to be able to grow back in the brush pile scars, so we also tested seeding native species. We had four treatment combinations. "Burned pile" plots were under a brush pile that was burned; they were also seeded with native plants. "Burned" plots were outside a brush pile but were also burned and seeded. The "seeded" plots were only seeded without any burning, and finally the "control" group had no treatment applies. The burning and seeding treatments were applied in early 2020. We collected cover data for KR bluestem and all native species in 2018-2019 (pre-treatment data) and from 2020-2022 (post-treatment data). Unfortunately, overall, the burn piles have not stopped the spread of KR bluestem as much that would be needed for this to be an effective way to stop the invasive grass. However, there was some significant difference between the percent of KR Bluestem cover found in the "burned pile" treatment group versus the "control" group. Using the R programming language, boxplots of the percent of KR cover for each treatment were made to compare the distribution between the groups. In addition, the Kruskal-Wallis test and Dunn test were used to find which treatment groups had a significant difference in KR cover. Bar graphs were used to compare the total native and invasive species cover for the "burned pile" and "control" treatment plots throughout the years as well.

NI Revolutionizing Battery Testing: Enhancing Efficiency in Testing for Electric Vehicles

Presenter: Jason Klipple

During my summer internship at NI, I collaborated with the Battery Test Systems unit, specializing in battery testing for electric and autonomous vehicles. My role focused on front-end engineering using Angular to introduce a vital feature. I designed a system that allows users to add custom properties to work orders, streamlining floor engineers' tasks.
The custom property feature empowers engineers to tailor work orders to specific job tasks, improving workflow efficiency. This user- friendly interface enhances task execution, reduces errors, and boosts productivity. Engineers can adapt their processes to unique project needs, increasing flexibility.
This poster highlights the technical details and user benefits of the custom property implementation, demonstrating its intuitive usage. This innovation not only contributes to NI's success but also impacts the electric and autonomous vehicle industry by optimizing battery testing procedures. My internship at NI exemplifies my dedication to solving real-world challenges with innovative solutions.

Adhesion of Metal-Complex Particle Free Inks Using Low Temperature Cures on Polymetric Substrates

Presenter: Diogo Ledesma

Additional Authors: Mitchell Smith (Electroninks), Sneh Sinha (Electroninks), Brett Walker (Electroninks), Melbs LeMieux (Electroninks)

Metal-complex particle free conductive inks are a new class of conductive inks with applications in printed circuits, displays, and wearables. These particle free inks hold an advantage over the current generation nanoparticle inks since they can achieve conductivities as high as 90% of bulk silver with annealing temperatures as low as 40°C. In this study, the adhesion and resistivity of a screen printable metal complex ink was investigated based on the surface chemistry of the substrate used during printing. A 1.5-micron layer of silver was deposited and cured at temperatures as low as 60°C. Using ASTM Tape test, profilometer, and multimeter, the resistivity and adhesion of the particle free ink on each type of substrate was analyzed. The type of substrate printed on was found to largely affect adhesion and resistivity of the ink with certain polymetric substrates showing a resistivity of 20 uohm-cm with adhesion at 60°C. This study offers an insight regarding which substrates offer the best adhesion and lowest resistivity values when printing conductive inks. Further studies are needed to evaluate the long-term adhesion and resistance values of the ink prints.

Thermocouple Heat Retention Testing and TestWorkflow Measurements

Presenter: Taha Lewis

Using thermocouples hooked up to NI hardware, I tested the heat retention of various tumblers, and then displayed the results using LabVIEW.

Launcher for TestStand

Presenter: Johan Olvera

Additional Authors: Stephen Moeder, Daniel English, Ben Hall

With C# I was able to develop a software to launch TestStand in different configurations and streamline customizability. Although a part of a larger development process, I was able to start the progress of a valuable feature for TestStand

ecocomDP Shiny App: Biodiversity Data Search and Visualization

Presenter: Rafael Rangel

Additional Author: Eric Sokol

In order to make the data help by ecocomDP more findable, accessible, interoperable, and reusable, we came up with the idea to develop a user interface for the ecocomDP package using R's Shiny library. A user-friendly interface would make the data and visualization functions held within ecocomDP more easily accessible to a larger group of people.

Digital Media Tools in Forensic Science

Presenter: Maria Rodriguez

Additional Author: Derek Camacho

In a fast moving digital world, digital forensics is now being considered as useful as fingerprint identification and DNA analysis. Digital forensics has emerged as a forensic science field with no time for law enforcement agencies to prepare, but with a fast need for results, making it difficult for law enforcement agencies to adapt, learn and enforce digital forensics. The technologies and software's used across different agencies varies based on their capabilities and the agency's workload. This research seeks to present the different technological software's and tools used across the different agency levels, while gaining insight into the software's applications and capabilities.

Enhancing Sample Tracking with an RShiny App

Presenter: Deautaun Ross

Efficient tracking of diverse field samples remains a critical challenge in contemporary research enterprises, especially at large scales. NEON's expansive sample collection, with over 3,000 shipments annually from varied fields across the country, exemplifies this challenge. During my internship, I, with the guidance of my mentors, developed an RShiny App aimed at overhauling this tracking process. Integrating automated data retrieval from their Fulcrum API with an intuitive user interface, the app streamlines the sample tracking procedure. This innovation significantly reduces manual tracking efforts and enhances efficiency in sample management. With features like auto-populating dropdown menus, three-tiered data queries, and an interactive dashboard, the app offers a glimpse into the future of efficient and automated sample management. This poster delves into the app's features, the challenges faced during its development, and its potential impact on large-scale sample management.

Seeding Success: Plotting Nature's Narrative through Methodological Exploration

Presenter: Manuel Salazar

Additional Author: Charlotte Reemts (TNC)

This academic poster delves into the meticulous process of developing immersive narratives tailored for integration within the ArcGIS platform but can also be used as a general guide when creating a story. The study presents a systematic five-step methodology, encompassing Research, Idea Formation, Storyboarding, Meeting/Feedback, and Implementation. Through rigorous research and the cultivation of distinctive ideas, participants proceed with a systematic approach to visualize and structure narratives effectively using storyboarding techniques. Collaborative feedback sessions are employed to enhance the storytelling experience, ultimately leading to the successful implementation of interactive narratives within ArcGIS. This poster sheds light on the transformative synergy between storytelling and technology, providing valuable insights into the creation of engaging narratives for diverse audiences.

Isolation of Genomic DNA from the Gregarine Blabericola migrator to Perform Short-Read, Whole-Genome Sequencing

Presenter: Rebecca Schwarz

Additional Authors: Emeka Nnamani*, Rebecca Schwarz*, Charles R. Hauser, and Daniel A. Gold *Authors who contributed equal work

Estimates suggest that nearly every type of animal can potentially be infected by a protistan parasite belonging to the phylum Apicomplexa. Among the notable apicomplexans causing diseases in both humans and animals are the parasites responsible for malaria (Plasmodium spp.) and cryptosporidiosis (Cryptosporidium spp.). Gregarines, a subgroup of apicomplexans that infect invertebrates, are believed to have a close evolutionary relationship with Cryptosporidium spp. due to their similar specialized life cycle and lifestyle traits. The gregarine parasite examined in this study is Blabericola migrator because it is the sole gregarine known to infect the host species, Madagascar Hissing Cockroaches. Our objective was to extract genomic DNA from the gametocyst stage of the gregarine parasite due to its known external and environmentally resilient characteristics. To do this, we created an optimized DNA extraction protocol and evaluated the purity and integrity of the obtained samples using Nanodrop technology and agarose gel electrophoresis. To confirm the specificity of the parasite DNA compared to the host's, and potential bacterial contamination arising from the intestine of the host , we conducted PCR reactions utilizing DNA primers designed to amplify host, parasite-specific genes or genomic regions. By performing whole-genome sequencing of B. migrator, we aim to gain insights into the genetic composition and molecular mechanisms of the parasite's life cycle.

Automating Shipment Draft Manifest

Presenter: Anushka Siwakoti

During my internship , I had the opportunity to work on an exciting project focused on creating a webhook using R.
Webhooks are like giant blocks of conditional code. It only starts when it gets data or a payload from a api which is like a waiter taking your order. The api will take your order and send it to the webhook which then does things.
The primary goal was to automate data processing tasks. By integrating the webhook, the project aimed to automate repetitive data handling tasks, reducing the manual workload and minimizing the risk of human errors.

Preparation, Analysis and Limit of Detection of Ethanol and Isopropanol Calibration Standards using Thermo-Fischer Scientific Trace 1310 GC/MS

Presenter: Matthew Hafer

Faculty Advisor: Christopher Burnett *(St. Edward's University)*
Additional Author: Christopher Burnett

In the pursuit of precision in ethanol quantification within complex biological samples, the capabilities of Gas Chromatography/Mass Spectrometry (GC/MS) are harnessed. This study presents a qualitative method using GC/MS for ethanol determination, emphasizing the role of internal standards to compensate for variabilities. The process employs a two-stage separation and identification strategy: first by vaporizing samples in the GC system and then separating them in a 30-meter column, with challenges observed in separating ethanol and isopropanol due to their shared characteristics. A novel approach, employing an isothermic program and reduced sampling volume, allowed for better differentiation of these compounds, likening the process to Liquid Chromatography within a GC/MS framework. Comprehensive preparation, sterile practices, and calibration curve development ensured the transformation of a primarily qualitative technique into a quantitative one. Methods encompassed temperature, concentration, volume, scan-range, and solvent testing, and a defined procedure using Thermo-Fisher Scientific Trace 1310 GC/MS. Conclusively, this research offers a standardized method for ethanol quantification in diverse analytical applications. This methodology, with its innovative approach, has significant implications for industries and research domains demanding exact ethanol concentration determinations.

Quantitative Commercial Egg Research Vs Farm Raised Egg Research Using High Performance Liquid Chromatography

Presenter: Madison Slavin

Faculty Advisor: Christopher Burnett *(St. Edward's University)*

The topic of egg research has been somewhat of a controversial topic within the scientific community because many results have been found to be inconclusive when comparing the benefits of farm raised eggs to store bought eggs. Interestingly enough it is the industry funded egg research that is downplaying the danger of cholesterol in commercial eggs. This study revolves around the comparison between farm raised eggs sourced in Georgetown Texas vs commercial eggs from a mass produced large chain supermarket. What was specifically looked at in this study is the presence of carotenoids within the egg yolks of both competing eggs. We used a High Performance Liquid Chromatography (HPLC) in order to detect the presence of zeaxanthin. HPLC is an analytical instrument that separates mixtures based on polarity using different polar solvents washed through in a gradient. We used a Thermo Scientific Hypersil GOLD C18 Selectivity HPLC Column to conduct our testing in order to ensure that there were consistent separations and notable peak shape. Our mixture will be separated into different compounds, from there the compounds will go into the UV detector, which will take a full spectrum scan of each compound. This full spectrum scan will show the maximum absorbance wavelength, that allows for identification of the compound. We tested Ocuvite, a supplement with specific carotenoids, zeaxanthin and lutein advertised to help replenish essential eye nutrients, as a standard to compare the level of carotenoids in egg yolk. These two carotenoids found in egg yolk can be separated and quantified using HPLC and can be a means of comparing store-bought to backyard chicken eggs, in addition to cholesterol. In this study we used calibrated UV-vis spectral data to run egg yolk samples and quantify the amount of carotenoids present in commercial and backyard eggs, while using the beta carotene as a standard solution.

The analysis of *Punica granatum* and *Terminalia chebula* for antimicrobial activity

Presenter: Dalila Aranday

Faculty Advisor: Dr. Trish Baynham *(St. Edward's University)*
Additional Author: Patricia J. Baynham

In the U.S., over 2.8 million people acquire and 35,000 people die from antimicrobial-resistant (AMR) infections. The overuse of antibiotics is one of the leading causes of AMR. There is a demand for creating new treatments to reduce the impact of AMR infections. *Punica granatum* (pomegranate) and *Terminalia chebula* (black myrobalan) extracts were evaluated to determine if they displayed antimicrobial activity. The pomegranate rinds were blended with water, filtered, and dried by rotary evaporation. Black myrobalan powder was extracted in methanol, filtered, and dried by rotary evaporation. For both, the solid was resuspended in water to a concentration of 100 mg/mL. Extracts were tested for antimicrobial activity by using the Kirby-Bauer Disk Diffusion assay against *Escherichia coli lptD4213-* , a strain that contains a mutation that causes a permeable lipopolysaccharide layer. The average zone of inhibition for the pomegranate extract was 10.75 mm and for the black myrobalan extract this was 8 mm. In order to determine if these extracts could be used to target AMR bacteria, they were tested against *Staphylococcus aureus 269* , a strain that is resistant to methicillin and vancomycin using the Kirby Bauer disk diffusion. In these assays the average zone of inhibition for the black myrobalan was 15 mm and for the pomegranate was 20 mm. It is significant that AMR *S. aureus* , which causes serious infections in the bloodstream, was sensitive to the plant extracts. This suggests that these extracts could be developed into therapeutic agents that target AMR strains. To further quantify the antimicrobial activity, a minimum inhibitory concentration (MIC) assay was conducted using *E. coli lptd-* and indicated that both extracts had an MIC of 2000 ug/ml. Bacterial cytological profiling was used to identify the mechanism of action (MOA) of the extracts. Cells were treated with each extract and the observed morphological changes were compared to untreated bacteria and bacteria treated antibiotics with known MOAs. By characterizing the antimicrobial properties of plants, this will promote the development of new medications that will provide protection against AMR infections. The health of the populations relies on the development of new treatments in order to combat bacteria that have become resistant.

Thermal tolerances of two native lizards and the implications of a changing climate

Presenter: Gabriel Eddy

Faculty Advisor: Dr. Elijah Wostl *(St. Edward's University)*
Additional Authors: Amelia Valencia, Elijah Wostl

Diurnal lizards depend on the environment to maintain operative body temperatures and may be exceptionally sensitive to increases in ambient temperatures.
To investigate the potential impacts of global warming on two species of lizards native to Travis County, Texas, we measured the preferred body temperature (Tset) and voluntary thermal limits (VTmax and VTmin) in a lab. We then compared these data to over a year's worth of hourly temperature data, collected hourly, from our study site at Wild Basin Wilderness Preserve and calculated the proportion of the year that is climatically favorable to lizard activity. We repeated the analyses under scenarios that assumed a 0.5°C, 1.0°C, 1.5°C, and 2.0°C increase in ambient temperature.
For both species the number of hours outside the voluntary thermal limits decreased as ambient temperatures increased. However, for one species, the number of hours within their optimal temperature range decreased by 1/3 with just a 0.5°C increase in ambient temperatures.

The Effects of Dietary Protein Levels on Expression of Parkinson's Disease Symptoms in *D. melanogaster.*

Presenter: Sofia Fernandez

Faculty Advisor: Dr. Lisa Goering *(St. Edward's University)*
Additional Authors: Blen Abegaz, Dr. Lisa M. Goering

Parkinson's disease is a neurodegenerative disease that presents itself through loss of mobility, physical tremors, and muscle rigidity; additionally, Parkinson's patients have a reduced life-span. These symptoms are the result of apoptosis of dopamine producing cells, which form Lewy bodies in the brain. Studies have shown that Levodopa, a common drug for Parkinson's disease, is not as effective in patients consuming a high-protein diet. In this study, we used a transgenic *Drosophila melanogaster* model to determine whether varying dietary protein exacerbates or ameliorates the symptoms of disease. Our hypothesis is that Parkinson's flies consuming a low protein diet will have improved mobility and a longer lifespan. Our data suggests there is not a relationship between diet and the severity of Parkinson's symptoms, however we are working to refine the assay to ensure more accurate results.

Assessing the effects of genetic background on EGFR pathway expression and function in *Drosophila melanogaster.*

Presenter: Makena Gonzalez

Faculty Advisor: Dr. Lisa Goering *(St. Edward's University)*
Additional Authors: Sofia Martin, Dr. Lisa Goering

Diseases like cancer are genetically heterogeneous, which makes diagnosis, and developing a clear treatment plan, challenging. Even when a causative mutation has been identified, genetic variation at modifier loci - an individual's "genetic background" - can cause variability in phenotypic expression of symptoms and in response to treatment. Here we examine the contribution of genetic background to the phenotypic expression of mutations in the Epidermal Growth Factor Receptor (EGFR) pathway. In humans, EGFR pathway mutations may cause certain types of cancers, such as lung adenocarcinomas. In *Drosophila melanogaster*, signaling through the EGFR pathway determines positioning of dorsal appendages on the eggshell, with high levels of signaling resulting in wider-set dorsal appendages. Previous work in our lab demonstrates that genetic background does have an effect on severity of EGFR pathway mutations. Our current focus is to explore a more proximal transcriptional target of the pathway - expression of *Broad*. Our hypothesis is that the dorsal appendage phenotype is correlated to the level of expression of *Broad*; we have isolated and amplified a portion of *Broad* from wild type flies and have cloned the gene into a plasmid vector. With the *Broad* gene cloned, we will create an RNA probe to analyze differential spatial expression of *Broad* in flies from two genetic backgrounds and harbor various EGFR pathway mutations. This research will further elucidate the role genetic background plays in determining complex disease phenotypes in humans that arise from mutations in the EGFR pathway.

Natural VOC's yield potential inhibition over Neolentinus lepideus

Presenter: Chloe Green

Faculty Advisor: Dr. Mary Kopecki-Fjetland *(St. Edward's University)*

Neolentinus lepideus is a fungus found within Asia and North America and is known to consume lumber and railway sleepers, but can be inhibited with natural VOC's yielding greater longevity and yield over our finite resource. VOC's naturally produced by the Trichoderma fungal species including benzaldehyde, caryophyllene, and 6-methyl-5-hepten-2-one have been found to reduce, or fully inhibit, the growth of other types of fungi. In this study, we examined the potential inhibition of *Neolentinus lepideus* by combining benzaldehyde/6-methyl-5 hepten-2-one and caryophyllene/6-methyl-5 hepten-2-one respectively at various concentrations. Previous work indicated 125 ug/mL benzaldehyde produced 90-percent inhibition. Caryophyllene produced no inhibition. We tested combinations of these VOCs in order to determine if synergistic effects exist. The 100 ug/mL benzaldehyde/6-methyl-5-hepten-2-one combination yielded 80-percent while the caryophyllene/6-methyl-5-hepten-2-one yielded no inhibition. Our findings suggest that there may be a natural fungicide via combined VOC's derived from the Trichoderma fungal species which in turn can yield greater amounts of lumber and an increased lifespan of railway sleepers. Future research will focus on testing more concentrations that are closer to 100 ug/mL and utilizing other naturally occurring VOC's.

Producing Ethanol Tolerant Mutants of Saccharomyces cerevisiae 09-448 using UV Mutagenesis

Presenters: Aaliyah Gutierrez-Cano, Jennifer Osorio Ferretiz

Faculty Advisor: Dr. M. Claire Edwards *(St. Edward's University)*

Climate change has prompted the search for fossil fuel replacements, like biofuels, made from the fermentation of biomass. *Saccharomyces cerevisiae* UCDFST 09-448 from the Phaff Yeast Culture Collection, hereafter referred to as 09-448, is a yeast strain capable of fermenting pectin-rich biomass. Unlike industrially-used yeast strains, 09-448 produces its own pectinase enzymes needed to degrade the pectin polysaccharide into smaller oligosaccharides. Commercial pectinase enzymes are commonly purchased to pretreat the pectin-rich biomass before industrially-used yeast strains ferment it. However, using 09-448 would eliminate the need for this purchase, making the overall fermentation process more economically feasible. 09-448, though, cannot yet be used industrially because it cannot withstand industrial stressors, such as increased ethanol concentration, temperature, and osmotic pressures. To produce an ethanol-resistant mutant capable of surviving under fermentation conditions, 09-448 was exposed to UV radiation for up to three minutes. Potential mutants were then screened for ethanol resistance by measuring their growth with a plate reader in ethanol concentrations up to 6%. Of all 12 mutants that were screened, eight performed better than 09-448 at both 4% and 6% ethanol concentrations. Mutant 12 seemed the most promising with a final OD of 1.15 and a minimum generation time of 65 minutes compared to the wild type with a final OD of 0.633 and a minimum generation time of 70 minutes when grown in 6% ethanol. The increased ethanol resistance of these mutants demonstrates a potential for these mutants to be used in a more cost-effective, large-scale fermentation of pectin-rich biomass, producing additional biofuel that can replace petroleum in gasoline and decrease the impact transportation has on climate change.

Native and invasive grasses respond similarly to spring drought in the Texas Hill Country

Presenter: Rylie Katz

Faculty Advisor: Dr. Kimberly O'Keefe *(St. Edward's University)*
Additional Authors: A. Dale, Dr. Amy Concilio, Dr. Kimberly O'Keefe

Invasive species can have negative consequences on native plant communities; however, we do not know how invasive and native plants will respond to global climate change pressures such as drought. It is important to understand these responses to a changing climate in order to better predict how plant communities will function in the future. This research aims to compare how native and invasive grasses function under drought in the Texas Hill Country. We compared physiological and morphological traits between droughted and ambient rainfall conditions in the invasive grass King Ranch Bluestem (*Bothriochloa ischaemum*) with the native grasses Big bluestem (*Andropogon gerardi*), Sideoats grama (*Bouteloua curtipendula*) and Switchgrass (*Panicum virgatum*). Photosynthesis was measured using an LI-6800 gas analyzer, midday water potential with a pressure chamber, specific leaf area with ImageJ and an analytical balance, and stomatal density with a compound microscope throughout May-June 2023. We observed species-specific differences in photosynthesis, leaf traits, and water potential, particularly as plant functioning declined over time in response to drought. There were also significant differences in water potential across different months and precipitation treatments between invasive B. ischaemum and the native species. These data will act as a foundation for subsequent experiments documenting how restored and invaded grasslands in the Hill Country react to changing drought conditions.

Fly Fight Club: Investigating the role of dietary protein on the expression of aggressive behaviors.

Presenter: Aidan Manno

Faculty Advisor: Dr. Lisa Goering *(St. Edward's University)*

The complex social behavior of aggression is hard to quantify and there are many aspects of this complex behavior that we still do not understand. Aggressive behavior is necessary for an organism's survival, as it provides access to necessary resources, including food, territory and mates; however, excessive aggressive behavior can be disadvantageous as it can be energetically expensive and expose an individual to unnecessary harm. Here we explore the effect that diet has on aggression. The purpose of this experiment is to design a way to effectively quantify aggression among male *Drosophila melanogaster*. Flies will be raised on either a high or low protein diet for at least three generations before being used in aggression assays. This assay

involves using food for flies to establish their territory. The two male flies (one raised on a high-protein diet and one raised on a low-protein diet) would be starved before being placed in a chamber together with food, and it is expected that one of the two flies will establish a dominance relationship with aggressive behavior. Defined aggressive behaviors such as fencing, wing threat, courtship, etc. will be scored during the 10 minute fight. Our hypothesis is that the group of flies on a high-protein diet will show higher levels of aggression than those on a low-protein diet. Our results will contribute to an understanding of the way environmental variables may influence complex behaviors.

Evolution of *cis*-regulatory elements leads to gene expression variation between *Drosophila melanogaster* and *Drosophila simulans*

Presenter: Charbel Maroun

Faculty Advisor: Dr. Lisa Goering *(St. Edward's University)*
Additional Authors: Rahjewel Barnhill, Andrea Pavia, Dr. Lisa M. Goering

In *Drosophila*, anterior-posterior patterning is a highly conserved process of early embryogenesis, determined by a set of transcription factors. *Cis*-regulatory elements, like promoters and enhancers, regulate the various developmental stages of eukaryotes. There is concrete evidence showing that evolution of *cis*-regulatory elements is a major generator of phenotypic diversity (Krishnan et al. 2022). The *orthodenticle* (*otd*) gene acts early to direct the development brain, head and eyes in *Drosophila* and is homologous with the human *otx* gene that is required for brain development. The maternal transcription factor Bicoid initiates early development and activates genes such as *otd*. *Bcd* mRNAs are deposited maternally in the egg; translation of Bcd protein creates an anterior-posterior concentration gradient, which decreases as it gets closer to the posterior end of the egg. *Otd* transcription is activated in the anterior, at high levels of Bcd. Even though the patterning process is highly conserved, there is standing genetic variation in transcriptional regulatory networks within different *Drosophila* species. This suggests there may be intraspecific functional polymorphisms (Goering et al. 2009). In this research, we are examining spatial expression pattern of *otd* in *D. simulans* and perform a comparative analysis to the pattern in *D. melanogaster*.

Light sheet fluorescence microscopy and patterns of structures in the human kidney

Presenter: Sofia Martin

Faculty Advisor: Dr. Lisa Goering *(St. Edward's University)*
Additional Authors: Sanjay Jain (Principle Investigator, Washington University School of Medicine), Bo Zhang (Washington University School of Medicine), Liam McLaughlin (Washington University Center for Cellular Imaging).

In order to determine how disease affects the structures in the kidney, healthy reference tissues must be studied. Human kidneys are responsible for filtering the blood, selectively reabsorbing filtered substances back into the blood, and secreting waste to be excreted through urine, all essential functions that can be impaired by disease. This project sought to identify patterns of structures in healthy human kidney tissues to create a reference for differentiating patterns of disease. These patterns were identified using light sheet fluorescence microscopy: a novel technology that produces 3D images of biological tissues by stacking 2D planar images of fluorescently labeled tissue samples. Human kidney tissue samples were stained with different fluorescent markers to identify various cell types of various kidney structures. The glomerulus structure became a focus for analysis and quantification of the produced light sheet images, using the imaging software Imaris.

Isolation of Genomic DNA from the Gregarine Blabericola migrator to Perform Short-Read, Whole-Genome Sequencing

Presenter: Emeka Nnamani

Faculty Advisor: Dr. Daniel Gold *(St. Edward's University)*
Additional Authors: Rebecca Shwartz, Dr. Charles Hauser, Dr. Daniel Gold

Estimates suggest that nearly every type of animal can potentially be infected by a protistan parasite belonging to the phylum Apicomplexa. Among the notable apicomplexans causing diseases in both humans and animals are the parasites responsible for malaria (Plasmodium spp.) and cryptosporidiosis (Cryptosporidium spp.). Gregarines, a subgroup of apicomplexans that infect invertebrates, are believed to have a close evolutionary relationship with Cryptosporidium spp. due to their similar specialized life cycle and lifestyle traits.

The gregarine parasite examined in this study is *Blabericola migrator* because it is the sole gregarine known to infect the host species, Madagascar Hissing Cockroaches. Our objective was to extract genomic DNA from the gametocyst stage of the gregarine parasite due to its known external and environmentally resilient characteristics. To do this, we created an optimized DNA extraction protocol and evaluated the purity and integrity of the obtained samples using Nanodrop technology and agarose gel electrophoresis. To confirm the specificity of the parasite DNA compared to the host's, and potential bacterial contamination arising from the intestine of the host , we conducted PCR reactions utilizing DNA primers designed to amplify host, parasite-specific genes or genomic regions. By performing whole-genome sequencing of *B. migrator*, we aim to gain insights into the genetic composition and molecular mechanisms of the parasite's life cycle.

Determining the antimicrobial effects of *Eysenhardtia polystachya* and *Pinus maritima* extracts to combat antimicrobial resistance

Presenter: Nicholas Purcell

Faculty Advisor: Dr. Trish Baynham *(St. Edward's University)*
Additional Authors: Nichole Abrego, Patricia Baynham

In the United States in 2019, over 2.8 million people acquired antimicrobial-resistant (AMR) infections, and over 35,000 people died from an AMR infection. The global rise in AMR infections and lack of effective treatments is an imminent threat and must be addressed. The overuse of antibiotics is one of the leading causes of AMR infections. In this study, two plants were assessed to determine if they displayed antimicrobial activity *Eysenhardtia polystachya* (Palo Azul) and *Pinus maritima* (Pine Bark). Palo Azul contains compounds that are potential therapeutics for diabetes mellitus and has been shown to have antioxidant activity along with hepatoprotective effects and potential antimicrobial effects. Pine Bark is known to contain beneficial polyphenols with antioxidant, anti-inflammatory, and antimicrobial effects. The palo azul extract was prepared by grinding bark into powder and extraction with a methanol/water solution, which was filtered, concentrated by rotary evaporation, and resuspended in water. Pine bark extract was made by extracting powdered bark with water, which was then filtered and condensed by rotary evaporation. In both cases the solid was resuspended in deionized water to a concentration of 100 mg/mL. The extracts were then evaluated for antibiotic activity using Kirby-Bauer disk diffusion assay against *Escherichia coli lptD4213*-, which contains a mutation that results in increased permeability of the lipopolysaccharide layer. Both showed antimicrobial activity with average zones of inhibition of 7mm for palo azul extract and 10mm for the pine bark extract. To better quantify antimicrobial activity, a minimum inhibitory concentration (MIC) assay was performed and indicated MICs of 1,280 ug/mL for palo azul and 640 ug/mL for pine bark. Bacterial cytological profiling (BCP) was then conducted to identify the mechanism of action (MOA) of the extracts. BCP consists of treating bacteria with the antimicrobial agent and investigating visual changes in cell morphology. The changes caused by the extract can then be compared to changes from antibiotics with known MOAs and untreated cells. Cells were treated with palo azul, pine bark, and the antibiotics ciprofloxacin, tetracycline, and ampicillin. Morphology changes were visualized using a confocal microscope and the fluorescent dyes FM4-64, which dyes membranes red, and DAPI, which dyes DNA blue. The effects of the known antibiotics included condensed DNA and elongated cells, and treatment with palo azul extract resulted in elongation, while treatment with pine bark extract showed both elongation and DNA condensation. Repeating BCP for both extracts will allow identification of their MOAs. By identifying and characterizing antibacterial properties of plants, this will open avenues of development of new therapies for AMR infections. Personal and global health depend on the identification and development of novel treatments to combat the rise in resistant bacteria.

Exploring the Value of Aquatic Foods Through a Public Health Lens

Presenter: Mia Sanchez

Faculty Advisor: Dave Love, PhD *(Johns Hopkins Center for a Livable Future)*
Additional Authors: Liz Nussbaumer, MPP (Johns Hopkins Center for a Livable Future), Dave Love, PhD (Johns Hopkins Center for a Livable Future)

Aquatic foods including fish, shellfish, crustaceans, and seaweed are consumed by more than 3 billion people around the world. The aquatic food system encompasses all activities and actors needed to produce, process, distribute, and consume aquatic food. The aquatic food system impacts economics, livelihoods, diet, and health and can be influenced by external factors such as climate change, government, and trade. Aquatic foods can be a vital tool for achieving public health-related goals of food security, environmental sustainability, and equity and justice. Using peer-reviewed research articles, government reviews, and non-governmental reports, this literature review examines how aquatic foods can be used as a tool in public health. This information can be utilized by community members, businesses, and policymakers to better understand the impacts of aquatic foods on health and policies and interventions to further promote aquatic food systems.

The Effect of Energy Expenditure on Immunological Response Between Drones and Worker Honeybees

Presenter: Gerad Sandate

Faculty Advisor: Dr. Matt Steffenson *(St. Edward's University)*
Additional Authors: Andrea Flores, Dr. Matthew Steffenson

Colony Collapse Disorder (CCD) occurs when worker honeybees leave a colony and disappear without reason. Among many hypotheses, it is believed CCD is induced when an accumulation of stress factors surpasses the threshold in which honey bees operate. This is detrimental to the species, and others, since the ecosystem relies on honey bees for pollination. It is believed that prevalence of CCD may be influenced by immunological threats. Honeybee colonies operate within a hierarchical system. Female bees are the workers responsible for scavenging, building honeycombs, and producing honey. Males bees, known as drones, essentially deplete the nutrients produced by worker bees until they mature, leave the colony, and reproduce. The only female bee with developed ovaries is the queen who is responsible for reproduction. This difference in roles accomplished by each class of bee requires a different amount of energy.The goal of this project was to determine if energy expenditure between drones and workers affects immunological responses since workers are constantly exposed to a myriad of pathogens when they leave the hive, as opposed to the drones who mainly stay within the hive.

The effect of apiculture stressors on the immunological response of Italian honeybees

Presenter: Elyse Wick

Faculty Advisor: Dr. Matt Steffenson *(St. Edward's University)*
Additional Authors: Matthew Godino, Matthew Steffenson

Colony collapse disorder (CCD) has caused widespread death of honeybees, but the exact causes are not understood. Many scientists, however, agree that pathogenic threats most likely contribute to CCD. Due to the integral ecosystem role bees fulfill, it is important to understand how honeybees respond immunologically to different factors to better inform practices to combat CCD. Quantifying the immunological cost of two different beekeeping approaches allows us to better understand how beekeeping practices affect bees' susceptibility to CCD. Two colonies were maintained, one with an internal plastic foundation on their frames and one without. The frame foundation provides structural support for the creation of honeycomb. Beekeepers utilize frames with no foundation to harvest beeswax. However, beeswax is more energetically costly for colonies to produce, causing energetic stress, which affects the colony's ability to fight pathogens. We collected bees from each colony and extracted their hemolymph to quantify their basal immunological protein levels to determine if frames with no plastic foundation resulted in the colony being less able to combat pathogens. Preliminary data suggests that bees from colonies with a plastic foundation will have higher levels of intracellular immunological proteins and, thus, will be more capable of fighting immunological threats.

Ecological restoration provides increased ecosystem services in grasslands of Central Texas

Presenter: Savanah Zambrano

Faculty Advisor: Dr. Kimberly O'Keefe *(St. Edward's University)*
Additional Authors: Elizabeth Payne, Dr. Kimberly O'Keefe, Dr. Amy Concilio

Ecological restoration promotes biodiversity which can increase ecosystem services in grasslands, for example by increasing floral resources for pollinators, productivity, and resilience to stressors. Climate change is leading to longer, drier summer seasons in Central Texas, which will likely impact plant communities differently based on their diversity and composition. Our objectives were to quantify the effects of drought on plant species composition and ecosystem services in Central Texas grasslands that were restored compared to those that were invaded by King Ranch bluestem (*Bothriochloa ischaemum*). We collected data at 10 sites (5 restored, 5 invaded), with 3 plots per site (control, spring drought, and fall drought), on a private ranch in Spicewood, TX. We surveyed plant community composition (point-intercept, 1m2 quadrats), dry weight of biomass (by clipping, drying, and weighing all aboveground growth in three 20 X 50 cm2 quadrats per plot), and floral resources (abundance and diversity of open flowers in 1m2 plots monthly from May to Sept). Most data was collected in spring 2023 before fall drought treatments were applied. We found higher species richness (p¡ 0.0001), greater biomass (p=0.006), and more floral resources available for pollinators (p=0.0012) in the restored treatment than invaded. Spring drought decreased overall plant cover, but had minimal impacts on species composition. We anticipate measuring more pronounced changes to the plant community in response to drought over time, with differential impacts on ecosystem services in restored vs invaded sites. Results from this experiment can be used to inform better management of grassland ecosystems in our region.

Optimizing *Saccharomyces cerevisiae* 09-448 Fermentation: A Standardized Approach for Stressor Manipulation

Presenters: Derrick Cardenas, Basheer Saqer

Faculty Advisor: Dr. M. Claire Edwards *(St. Edward's University)*

Our dependence on fossil fuels has contributed to global warming, food instability, and energy depletion. This has driven the search for sustainable alternatives like bioethanol, a promising biofuel. Bioethanol production converts plant biomass into ethanol through the fermentation of sugars using microorganisms like *Saccharomyces cerevisiae*. *S. cerevisiae* UCDFST 09-448 from the Phaff Yeast Culture Collection hereafter referred to as 09-448 produces a pectinase for cell wall degradation allowing it to produce maximum ethanol in the absence of commercial pectinase enzymes, increasing the feasibility of large-scale production of ethanol. To replicate large-scale industrial fermentations, it is essential to establish a standardized procedure for conducting bioreactor fermentations in a laboratory setting. Standardized procedures allow for consistent evaluation of 09-448's performance against a range of stressors in industrial-scale fermentations. A bioreactor procedure was developed by comparing data from various bioreactor runs inoculated using different methods. To validate the inoculation procedures, the following variables were measured and compared; optical density at 600nm, ethanol concentration measured with GC/MS, glucose concentrations measured with DNS assay, oxygen concentrations and base addition. Samples were taken approximately every 3 hours for 36 hours. First, bioreactors were inoculated with 20 mL of overnight 09-448 culture, but the growth curves of these runs were inconsistent. Next, bioreactors were inoculated with a final OD of 0.01 to ensure the same amount of cells were contained within every inoculum. This method is expected to result in consistent results that can be used to study the effect of stressors on 09-448 fermentations.

Quantitative Research into Cholesterol Content of Backyard and Commercial Chicken Eggs

Presenter: Leon Burgher

Faculty Advisor: Christopher Burnett *(St. Edward's University)*
Additional Authors: Madison Slavin, Christopher Burnett

Chicken eggs are a widely available source of cholesterol. In recent years, commercial demand for more ethically sourced eggs has risen. One such source is eggs produced from privately raised chickens, or "backyard eggs". There is literature comparing the chemical and nutritional content of eggs from hens in cage and free-range production, but there is little data comparing commercially sourced eggs to backyard eggs. We extracted cholesterol from egg yolk by adding 1 gram of yolk to a 2:1 15 mL solution of chloroform and methanol, plus an additional 5 mL of water, centrifuged for 10 minutes at 2500 rpm. The chloroform layer was extracted and filtered through cheesecloth. We used the Zlatkis et. al. method of serum cholesterol quantification and created a calibration curve using stock cholesterol. Five backyard eggs from two different flocks of hens and four grocery store eggs were evaluated using this calibration curve. We found that the backyard eggs had on average 0.054g greater cholesterol content than the commercial eggs. We also found that the variation of cholesterol content in the backyard eggs was much greater than that of the commercial eggs, with standard deviations of 0.0117 and 0.0032 respectively.

Exploring Synergistic effects of VOCs on the growth of Neolentinus lepideus

Presenter: Eugene Inotu

Faculty Advisor: Dr. Mary Kopecki-Fjetland *(St. Edward's University)*

VOCs are volatile organic compounds that are known for their high vapor pressure and low water solubility. They are produced in the manufacture of paint, refrigerants, pharmaceuticals and naturally by organisms such as plants and microorganisms. VOCs are found in multiple fungi, especially Trichoderma viride and are responsible for growth inhibition in other fungi. The point of this research was to identify some Trichoderma viride VOCs that inhibit the growth of Neolentinus lepideus (cause of wood rot) and also to explore if there is a synergistic effect between VOCs on the growth of Neolentinus lepideus. In this experiment, we determined if the VOCs, limonene and methylacetate at 250 micrograms per milliliters each, or the combination thereof, caused growth inhibition in Neolentinus lepideus. Results showed that limonene caused a large inhibition of growth which aligns with previous literature reports in other fungal species. On the contrary, methylacetate acted as a strong growth promoter. The combination of limonene and methylacetate showed no synergistic effects at a high concentration of 250 micrograms per milliliters each. Future research includes testing other VOCs on the growth of Neolentinus lepideus and trying to determine if there are any synergistic effects between known VOCs that are growth inhibitors.

HPLC UV-Vis Analysis of Energy Drinks

Presenter: Alayna Valentin

Faculty Advisor: Christopher Burnett *(St. Edward's University)*
Additional Authors: Diogo Ledesma, Christopher Burnett

Over the last decade, energy drinks have seen a substantial increase in advertisements and sales. The majority of energy drinks sold in the United States contain the alkaloid caffeine and the amino acid taurine. While these compounds offer some benefit to the consumer, taurine is known to negatively affect the developing brains of adolescents, while caffeine can prove harmful in large enough doses. Although most manufactures list the amount of caffeine and taurine in each product, this research aimed to verify the amount of each substance. UV-Vis detection relies on compounds being chromophores that absorb energy, and only the caffeine is a chromophore. In order to then properly quantify the amount of caffeine and taurine present in Sugar Free Red Bull, the chromophore o-phthalaldehyde was reacted with a Red Bull solution in order to make a taurine-phthalaldehyde derivative. High Performance Liquid Chromatography was used to separate each compound and UV-vis Spectroscopy was used to find their max absorbance wavelength, which allows for identification. Quantification of caffeine and taurine in each sample was achieved using calibrated UV-Vis spectral data. Overall, caffeine and taurine were both detected in higher levels than stated by the manufacturer. This research aimed to develop an instrumentation and analysis technique that can be applied

to the course Instrumental Analysis, allowing for development of skills in organic synthesis reactions and instrumentation techniques.

Comparing Campaign Ozone data to Satellite Data

Presenter: Samuel Flusche

Faculty Advisor: Dr. Paul Walter (St. Edward's University), Dr. Paul Savala (St. Edward's University), Dr. John Sullivan (NASA), Dr. Ryan Stauffer (NASA)
Additional Authors: Paul Walter, Paul Savala, Taylor Shingler (NASA), Marta Fenn (NASA), John Hair (NASA), John Sullivan (NASA), Ryan Stauffer (NASA), Tim Berkoff (NASA), Guillaume Gronoff (NASA) Jerald Ziemke (NASA), James Flynn (UH), Travis Griggs (UH), Alex Kotsakis (NASA), Gary Morris (NOAA), Laura Judd (NASA)

The Earth Polychromatic Imaging Camera (EPIC), attached to NASA's DSCOVR satellite, provides hourly 0.25˚ x 0.25˚ ozone measurements over most of North America and was active during the full month of September 2021, when the TRacking Aerosol Convection ExpeRiment–Air Quality (TRACER-AQ) campaign took place in the Houston Area. There were 62 ozonesondes (instruments attached to weather balloons) launched during the campaign, Pandora spectrometer instruments collecting ozone measurements, two ground-based ozone LiDARs (laser based measurements) as well as one downward facing ozone LiDAR attached on board a NASA aircraft. We report on an intercomparison between the ozone measurements of these instruments and those of EPIC. Preliminary analysis of the intercomparison between the sondes and EPIC showed good agreement for some atmospheric features but often showed differences in the amount of ozone in the troposphere. The Pandora measurements showed good agreement with EPIC, especially when considering the ozone amounts throughout the month.

Assessing the Black-Scholes Model

Presenter: Kaitlynn Harrylal

Faculty Advisor: Dr. Jason Callahan *(St. Edward's University)*

Assets of different types are traded in financial markets and their prices fluctuate wildly. Anticipating these price fluctuations could make one a great amount of money very quickly, so the prediction of these fluctuations has been analyzed using the famous Black-Scholes model to determine option pricing. This does not work on every investment due to certain limitations but is one of the most used techniques for pricing options, and economists continue to amend the model to make it more realistic. We analyze the price movement of 480 stocks in the S&P 500 during 2014 to assess the accuracy of the Black-Scholes model. We then apply this methodology to the year the pandemic began and compare the call options from the Black-Scholes model to market results.

Modelling the Battle of Raate Road

Presenter: Johann Keydel

Faculty Advisor: Dr. Jason Callahan *(St. Edward's University)*

We present four Lanchester models of differential equations with estimated parameters to model the Battle of Raate Road, which occurred between the Finnish and Soviet armies from Janauary 1 to January 7, 1940.

Implementation of the Moulinec-Suquet Approach to Homogenization

Presenter: Jessica Lozoya

Faculty Advisor: Dr. Berkin Dortdivanlioglu *(University of Texas)*

This research explores the application of the Homogenization approach in Python to determine the effective mechanical properties and stress distribution within 2D heterogeneous materials composed of periodic cell structures with representative inclusions and matrix materials. The study aims to provide a comprehensive understanding of how this computational technique can be utilized to analyze complex microstructures. Through numerical simulations and analysis, the study demonstrates the approach's ability to predict the composite material's overall mechanical behavior. The results highlight its potential significance in engineering design and material optimization by offering valuable insights into the characterization and performance prediction of heterogeneous materials.

Probabilities Associated with Lotería: Simulations with Multiple Tablas

Presenter: Natali Ramirez

Faculty Advisor: Dr. Michael P. Saclolo *(St. Edward's University)*

Lotería is a popular Mexican-Latinx household game that is played similarly to Bingo. However, instead of announcing letter-number pairs, small-numbered cards with culturally relevant images are called, and players mark their Lotería cards, called tablas, if that image is present. Using a program written in Python code to run game simulations, we compute the probability of winning for each card in the twenty tablas that make up the usual starter and expansion packs. We also use computer simulation to determine the cumulative probability distribution and compute the expected value for the number of calls that it takes to achieve a Lotería for games with multiple tablas in play at the same time.

Air quality and ozone concentrations in the El Paso region

Presenter: Harsh Vibhuti

Faculty Advisor: Dr. Paul Walter *(St. Edward's University)*
Additional Authors: Paul Walter, Mark Estes, Nayma Kim, Nakul Karle (UTEP, Howard University), Suhail Mahmud (UTEP, Penn State), Rosa Fitzgerald (UTEP), James Flynn (University of Houston)

El Paso, a city in west Texas with a population of 678k, is the 6th largest in Texas with more than 80 percent Hispanic population. The air quality in this region has been adversely affected due to rapid industrialization and urbanization. Nitrogen oxides mix with volatile organic compounds in the presence of sunlight to produce ozone, a secondary pollutant. Sustained exposure to elevated ozone levels can cause increased rates of respiratory diseases. This study analyzes 21 years of recent data from ozone monitors situated in and around El Paso, TX. The number of days in which the surface ozone concentration exceeded the acceptable limit for each day of the week at each station was determined and plotted on a graph. The stations closer to the border showed a larger number of exceedence days during weekends than the station farther away from the border. In the El Paso region there is a weekend effect, where a higher number of exceedence days occur, particularly on Saturdays, than on weekdays.

Physics

Examining Vertical Column NO2 during the 2021 TRACER-AQ Campaign in Houston

Presenters: Analee Maharaj, Tayo Castro

Faculty Advisor: Dr. Paul Walter *(St. Edward's University)*
Additional Authors: Paul Walter, Mark Estes, James Flynn (University of Houston), Elena Lind (NASA), Dave Felix (Texas A&M University-Corpus Christi)

We show preliminary data from two Pandora spectrometers operating during the 2021 TRacking Aerosol Convection ExpeRiment – Air Quality (TRACER-AQ) campaign in Houston. Each instrument is part of the Pandonia Global Network and were located at the University of Houston. One Pandora was located approximately 5 m above ground level while the other was on top of a building and was 70 m above ground level. Nitrogen dioxide (NO2) is a primary pollutant and a precursor to ozone formation (a secondary pollutant). Using the TRACER-AQ data, we plotted the total vertical column of NO2 as a function of time from the two different Pandora instruments. The instrument closer to ground level showed slightly higher levels of total vertical column NO2, which would be expected since it has more atmosphere to pass through and traffic and other sources lead to the highest concentrations of NO2 being near ground level. NO2 was higher in the morning during rush hour and lower in the afternoon when NO2 is used in the photochemical production of ozone. Ongoing work includes examining the NO2 data from the instruments on days when ozone in the region was high compared to days when ozone in the region was low. This initial analysis is part of a NASA-funded project that will install a Pandora spectrometer and an AERONET Cimel sun photometer on the roof of JBWS and St. Edward's will join the Pandonia Global network and AERONET.