Abstracts
Louisiana Tech University

Oral Presentations

Next Generation Sequencing Provides Pathogen Monitoring to Rural Communities
Michael Foster, Mattie Robison, Logan Eschalon, Kristin Jackson, Laura Lee, Paul Austin, Audrey Kim, Dr. Tom Bishop, Dr. Paul Kim, & Dr. Jamie Newman

Genetic surveillance is an integral part of pandemic readiness, and increases the ability of communities and institutions to monitor the presence of pathogens. Due to the widespread nature of the SARS-CoV-2 transmission, a more distributed approach to monitoring is required. In partnership with LSUHS-Shreveport, Grambling State University, and Mercer State University, we established a viral surveillance program to identify and monitor circulating variants of SARS-CoV-2. Previously, this level of surveillance has been limited to large institutions which biased samples towards larger cities and delayed sequencing of samples from more remote areas that had to be shipped to these facilities. Our approach sought to utilize accessible methods of genetic sequencing to sequence locally and generate results within 10 days of sample collection. Our approach supplemented the efforts of researchers worldwide by providing local SARS-CoV-2 genomic data. We implemented and developed sequencing protocols using the Oxford Nanopore Technologies MinION, a next generation sequencer. Each assembled viral genome was then uploaded to GISAID for use by other researchers. Through this we were able to analyze 295 patient samples and identified 33 unique variants. Through our approach, we were able to implement a viral surveillance program and successfully monitor circulating variants and identify novel mutations. We are currently expanding our use of these skills and tools to advance our on-going research in stem cell biology so that we may continue adding to a scientific community interested in improving health outcomes.
Oral session 1C

Building a Healthier Community Through Collaboration
Allissa Leggio & Lacey Deal

Through this research I am seeking to answer the question of how to increase community collaboration to influence the awareness and access to healthy lifestyle programming for youth populations.I have determined that communities and local school systems must work together to successfully meet the needs to prevent childhood obesity. A health and wellness committee on the parish or city level is recommended. I located research studies directly related to obesity, knowledge and promotion of physical literacy, programs within communities of similar size, and successful programs within other communities. For the research completed, internet research using the library database and google scholar, along with research on community websites, were used. Information gathered was developed into a presentation that will potentially be presented to Mayor Ronny Walker as a class project and recommendation for best practice in Ruston, LA to help combat the issue of obesity and lack of physical activity in youth of the community. This service project is scheduled to be presented at the end of January, 2023. My hope is that this would continue into future projects by working directly with the mayor's office and community members to see this committee formed in Ruston, LA. I have learned there are successful routes available to assist in promoting physical activity for youth and the community. Many organizations are doing great work in Ruston to make a difference in the lives of its youth, but collaboration would make an even bigger contribution.
Oral session 1D

4Paws Rescue Mission
Alyssa McReynolds, Heather Nutt, Cameron Hunter, Ella Avery, Heather Nutt, Cameron Hunter, & Brittany Beck

Through service learning, our group set out to save 4Paws Rescue– a no-kill animal shelter serving the Ruston community on the verge of closing due to unsustainable funding. Our mission was to help 4Paws achieve financial stability through substantial donations, event fundraising with local figureheads, and dog park memberships for steady income. In our Digital Marketing course, we learned how to develop an effective marketing strategy centered around the nonprofit's

needs. This entailed promoting 4Paws strategically on social media, designing a website geared for conversions, and using analytics to strengthen these efforts. As a result, we were able to raise over $20,000 in donations, over $3,500 in event revenue, secured 7 corporate sponsorships, and improved foot traffic to the shelter's website and social accounts to increase its visibility. As young professionals, we gained experience communicating with different types of people, delegating tasks, and working as a team. More importantly, this project taught us how important it is to give back to your local community and the struggles and triumphs that nonprofits face. We hope to leave a greater impact on society by spreading awareness about the importance of supporting local nonprofit organizations. Specifically, we aim to educate the greater Ruston community on the importance of no-kill animal shelters and how individuals have the opportunity to make a difference whether by donating, volunteering, or sharing information online. A scholarship would allow us to continue serving nonprofit organizations in the local community.

Oral session 2B

The Influence of Microgravity on Adult Stem Cell Self-Renewal and Osteogenesis

Lucas Norris, Calla Bunting, Dr. Joshn Vandenbrink, & Dr. Jamie Newman

For astronauts who have spent long periods of time on the International Space Station, a loss in bone density of 1-2% per month is common. This becomes problematic upon return to Earth's atmosphere because the loss in bone density has increased the fragility of the bones, therefore, increasing the risk of bone fractures. Human adipose-derived stem cells (hASCs) are multipotent stem cells that hold the potential to combat this significant challenge. Adipose-derived stem cells are critical in the advancement of regenerative medicine because they are easily obtained from adipose tissue and are able to both self-renew and differentiate. In order to maximize the efficiency of hASC therapies, we must first understand how their cell state is maintained and altered in the absence of gravity. This project investigates the effects of microgravity on hASC self-renewal and osteogenic differentiation under conditions of Earth's gravity and simulated microgravity. We will monitor self-renewal by comparing rates of metabolism, proliferation, and expression of genetic markers between standard culture conditions and simulated microgravity conditions. We will also induce differentiation of the hASCs and monitor the formation of bone cells using staining techniques and monitoring the expression of specific genetic markers. By initially observing changes in the rate self-renewal and osteogenic differentiation, we may begin to isolate pathways and factors that influence the diminishing bone health of astronauts. In addition, insights gained from this research may also translate to the development of treatments for those who suffer from osteoporosis and other bone degenerative diseases.

Oral session 2D

Relevant Primary Sources: Insight on the Revolutionary War Through General Israel Shreve's Personal Letters

Lauren Shirley & Dr. Elaine Thompson

This project's goal is to emphasize the importance of continually developing our understanding of historical events as we revisit them. With this, historical research originates at the innermost source we can study. Primary sources, created during the time in which we seek information, must continually be accessible to preserve the original stories within history. The Letters of Israel Shreve, a collection of letters written by the Revolutionary War general during his service, serves greater importance than initially imagined. His letters provide another relevant and detailed point of view from the Revolutionary War, covering topics from military movements, government actions, and life during the war. Viewing letters that contain unfiltered information about an important event allows gaps to be filled and create an even fuller picture of history. In order to establish what information could be extracted by Shreve's letters, they had to be very closely examined. The examination began with reading the transcriptions and the letters to proofread their contents. The method of analysis used for his letters was primarily noting names, locations, uncommon words, and the timeframe in which they were written, and researching them utilizing other primary sources from the war. By cross-referencing the information in his letters with letters from other war generals, maps, and official sources such as the Journals of the Continental Congress, lesser-known and unknown information was uncovered. Uncovering new and relevant information from a centuries-old source emphasizes how important it is for primary sources to be accessible for research and continual understanding.

Oral session 2C

An Analysis of Chromatic Polynomials
Emerson Statom, Dr. Galen Turner, & Dr. Stacey McAdams

Computer Scientists apply algebraic graph theory to address and interpret problems arising out of data structures and optimization. For example, graph coloring problems have plagued computer scientists and mathematicians alike. The chromatic polynomial was created to help solve these problems, but finding a graph's chromatic polynomial through the deletion-contraction method can be time consuming for both people and computers. By generalizing the form of the chromatic polynomial, we can drastically speed up the process. The chromatic polynomial has been generalized for several classes of graphs, but this research attempts to generalize polynomials for a specific class of graphs using algebraic graph theory. This generalization gives insight into a different way to calculate chromatic polynomials, using clique sums. While the clique sum method is limited in application, this process is substantially faster than the deletion-contraction method when it can be applied.

Oral session 2E

Injury Risk Assessment of NFL Quarterbacks
Julie Weems & Dr. Stan McCaa

Risk assessment is an important aspect of many careers such as first responders and military. This is no different for people who play sports, especially people who are in contact sports such as football. These players' lives can be changed forever with one bad hit. The goal of this research is to analyze the risk of an injury for the National Football League's (NFL) quarterbacks. It is hard to predict when, what, and where an injury will occur, because of this very little work has been done on the subject matter in a general form. The goal of this paper is to determine what variables play a role in factoring into a player being injured. The data was collected using NFL combine data as well as historical injury reports. We performed a multi-linear regression analysis with the variables and the number of weeks missed due to injury for the player. The multi-linear regression model was then used to create an injury risk matrix. This general model can be used for quarterbacks within the NFL to determine if they should keep playing based on their data during that time or end their career.

Oral session 1D

Poster Presentations

Role of the Notch Signaling Pathway and Conditioned Media in Human Adipose-Derived Stem Cells
Kate Horton, Olivia Hubbard, Suraj Patel, Isabella Redman, Sydney Mashaw, Mathew Burke, & Dr. Jamie Newman

Stem cells are undifferentiated cells that originate from one lineage and can self-renew and differentiate into specialized cells. Human adipose-derived stem cells (hADSCs) are mesenchymal stem cells harvested from adipose tissue that can differentiate into adipocytes, osteocytes, or chondrocytes. hADSCs have implications for regenerative medicine in areas of wound repair and degenerative disease. Stem cell fate can be directed by exposing cells to environmental stimuli or activating signal transduction pathways. The Notch signaling pathway regulates cell proliferation, differentiation, and fate in animals. The pathway consists of four cell surface receptors and five ligands. We will investigate how the Notch3 receptor affects hADSC self-renewal and differentiation potential to determine if it may be a targeted pathway to enhance stem cell clinical applications. To test this, we will lower the levels of notch3 expression and measure changes in self-renewal by monitoring colony formation, metabolic rate, and expression of ki-67, a gene which is highly expressed when cells are proliferating. We will also examine the secretome of cells expressing normal and decreased levels of Notch3. The secretome is the compilation of factors secreted by cells, so we will collect media from cells described earlier (conditioned media) and use that to culture hADSCs. We will then examine the influence that this conditioned media has on cell proliferation by again monitoring colony formation, metabolism, and ki-67 expression. Together these two sets of experiments will inform us about the role Notch3 plays in the maintenance of hADSC state and thereby contribute to possibilities in regenerative medicine.

Poster session 1A

Dynamic Sequestration of CO_2

Stuti Khatiwada, Dr. Sudhir Amritphale, & Dr. John Mathhews

The emission of the primary greenhouse gas, CO_2, has increased significantly over the years, causing the earth's surface temperature to rise. Therefore, it is important to find a method to mitigate the emission of CO_2. The present research work aims to use environmentally friendly pervious geopolymer concrete as a carbon dioxide capturer due to the presence of a strong alkali, NaOH. This research would focus on the use of geopolymer concrete to demonstrate an onsite dynamic sequestration system for carbon dioxide using sustainable materials like fly ash. Our main goal is to replace hazardous organic polymer-based scrubbers with non-toxic inorganic geopolymer-based pervious scrubber systems that can sequester CO_2 dynamically. While conducting our research experiment, we have taken three major process parameters into consideration: the concentration of NaOH, the porosity of pervious geopolymer concrete, and the flow rate of CO_2. The developed methodology will be useful for CO_2-generating industries like cement industries, steel industries, and thermal power plants. On the latter half of the experiment, we used lime water for the regeneration of NaOH.

$$NaOH + CO_2 \rightarrow Na_2CO_3 + NaHCO_3 + H_2O$$

$$Na_2CO_3 + NaHCO_3 + Ca(OH)_2 \rightarrow NaOH + CaCO_3$$

In addition to the regeneration of NaOH, this entire research focuses on the zero-waste concept.

Poster session 1B

Genome Sequencing for SARS-CoV-2 Surveillance and Future Applications

Madeline Robison, Logan Escalon, Kristin Jackson, Michael Foster, Laura Lee, Paul Austin, Lescia Valmond, Audrey Kim, Dr. Tom Bishop, Dr. Paul Kim,& Dr. Jamie Newman

With advancements in sequencing technology, monitoring the genetic evolution of pathogens is now more accessible than ever. During outbreaks, the ability to monitor viral mutations provides a unique perspective on the dynamics of viral spread and can provide insight into the potential trajectory of the outbreak. In 2021, we began sequencing SARS-CoV-2 patient samples to monitor viral mutations and identify variants present in Lincoln Parish. Our data was added to a global genome network, GISAID, where researchers around the world share data that is used in disease surveillance and public health. We collaborated with local clinics and Grambling State University to generate 295 sequences identifying 24 Delta variants and 271 Omicron variants in Lincoln Parish. Using the Oxford Nanopore Technologies MinION, we have optimized protocols for RNA extraction, sample validations, library preparation for sequencing, and pathways for data analysis. This project has allowed us to monitor SARS-CoV-2 variants within our local community and introduce sequencing technology to Louisiana Tech University. We look forward to using these tools and techniques in future projects, where monitoring changes in gene expression can deepen our understanding of stem cell biology.

Poster session 2B

Investigation of the Effect of Solvent and Concentration of Fluorinated Anions Encapsulated by Cyanostar using Nuclear Magnetic Resonance Spectroscopy

Spencer Stelly, Deepthi Chappidi, Yusheng Chen, Zhao Zhang, Maren Pink, Amar Flood, & Dr. Elisabeth Fatila

Fluorinated anionic compounds are well-known because of their utility as ligands to transition metal and lanthanide ions, as well as their persistence in the environment. We have been interested in the chemistry of binding fluorinated anions with size-selective macrocyclic ionophores. Through electrostatically binding with anions, these macrocycles effective isolate anions from solution, allowing potential means of environmental remediation. Previously, we investigated the binding of fluorinated anions, such as 1,1,1,5,5,5-hexafluroacetylacetone (hfac), with the five-fold symmetric macrocycle Cyanostar (CS). Cyanostar is unique in that it uses weak C-H bond donors to complex anions. We obtained unusual spectroscopic signatures in both 1H and 19F spectra when observing hfac in deuterated

chloroform. The observed alkene peak diminished at low concentrations and reappeared and converged at high concentrations. We will investigate the effect of solvent systems on anion binding by studying the effect of certain solvents such as chloroform and the NMR spectrum compared to the less acidic methylene chloride, as well as the effect of anion solvation using methanol. These studies will be conducted using 1H and 19F NMR spectroscopy, as well as obtaining solid-state crystallographic data and infrared spectroscopic data for comparison. From these findings, we can determine how cyanostar binds fluorinated organic anions and if decomposition, chemical exchange, or solvent effects are driving the formation of NMR signals. These results will assist others who are investigating binding of fluorinated species with macrocycles as to the origin of their unexpected spectra, as well as provide insight into the solution behavior of fluorinated species.

Poster session 1B