21st Annual TLSAMP Undergraduate Research Conference

March 1, 2024

(listed in alphabetical order)

Senior
Mechanical & Manufacturing Engineering
Tennessee State University
Dr. Muhammad Akbar
Oral

Computational Fluid Dynamics (CFD) Study of Boeing 737-800 Propulsion System

This research aims to study the propulsion system of a Boeing 737-800 aircraft by using the Computational Fluid Dynamics (CFD) model to accurately assess its performance. The initi(4 Th)(s (CF)5(D)

Sophomore
Chemistry
Vanderbilt University
Dr. John McLean
Oral

Development of Advanced Mass Spectrometry Methods for Pharmaceutical Enantiomer Characterization

Drug enantiomers can have different effects on the human body, varying in bioavailability and potency. In the famous case of thalidomide, one enantiomer can alleviate morning sickness during pregnancy while its chiral counterpart causes birth defects during gestation. The thalidomide crisis highlights the tragic consequences of enantiomeric differences in drug biological activity and underscores the importance of developing rapid analytical techniques for enantiomeric discrimination. Popular methods for enantiomer differentiation are limited by high sample consumption, long analysis times, and low sensitivity. Ion mobility-mass spectrometry (IM-MS) enables rapid gas-phase separation of many isomeric and isobaric compounds, but small molecular enantiomers share many chemical and physical properties, making them a famously difficult class of molecules to separate. A potential avenue to overcome this challenge is the use of chiral shift reagents which can interact enantioselectivity with the two chiral forms of a drug to impart measurable structural differences. This noncovalent complexation can render the two forms directly resolvable using IM-MS. Our previous work explored copper-amino acid complexes as chiral selectors, and current work seeks to complement .

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Junior
Biology
Lemoyne Owen College
Dr. Mark Kahn
Oral

in vivo

During gestation, the placenta serves as a temporary but invaluable link between the mother and fetus, mediating nutrient and oxygen exchange to the conceptus and subsequently preserving its capacity for normal development. Placental dysfunction can lead to many severe pregnancy complications, such as preeclampsia and intrauterine growth restriction (IUGR). Therefore, understanding the mechanisms of placental development is crucial to better address these complications and ultimately ensure successful pregnancy outcomes. Furthermore, endothelial cells (EC) play a significant role in vascularizing the placenta to facilitate nutrient and oxygen exchange between maternal and fetal blood. Understanding both normal and abnormal mammalian development requires specific knowledge of ECs; however, the mechanisms that govern placental EC functionality and behavior are not well understood. Particularly, there is a lack of information

different developmental stages. Therefore, this project aims to explore these characteristics *in vivo*, using the wildtype murine placenta. Click-iT EdU assay and other proliferating markers were applied to visualize proliferating cells in placentas at both early (E11.5) and late (E15.5) gestational timepoints. Different conditions of EdU administration to pregnant dames were also considered, which Ra ‘a

5. Sona Javadi
Junior
Computer Science
Vanderbilt University
Dr. Maizie (Xin) Zhou
Oral

Autoencoder with Differentially Expressed Genes and Imputation for a Robust Spatial Transcriptomics Clustering

Recent advancements in spatial transcriptomics (ST) sequencing technology have enabled a more in-depth understanding of tissue by allowing the measurement of gene expression among spots in tissue along with the spatial location of spots. There are multiple studies that have worked on further understanding the variation of gene expression in tissue, but most of the literature have utilized tools that were developed for single-cell RNA sequencing (scRNA-seq), only using the gene expression values of spots. However as stated, ST datasets also contain the spatial location of spots and often contain high-resolution histology images. These are very important aspects of the data which can allow a better understanding of tissue; however, they are seldom exploited thoroughly. In this study, we will discuss a novel graph-based multi-stage deep clustering method which integrates differentially expressed gene selection and imputation modules to refine clustering results.

6. Elise Russ
Senior
Civil Engineering
Tennessee State University
Dr. Shihui Liu
Oral

The Benefits and Construction Advances of Hempcrete

Hempcrete is an important construction industry advancement that focuses on replacing current non-bearing construction materials that negatively impact the environment. Hempcrete provides an alternative to costly materials and negative environmental factors, the typical cost of concrete is between $110 and $165 per cubic yard. Concrete contributes to negative environmental effects which include soil erosion, water pollution, and flooding. In the research methodology used, I have tested the compressive strength of hempcrete to identify its longevity and use in the field. The compressive strength of the samples is tested after 28 days with the relative humidity for the curing environment is 95%. It is important to identify various building materials as our world is evolving and we are looking to improve the environmental conditions around us.

7. Jymon T. Scott
Senior
Electrical Engineering
Tennessee Technological University
Dr. Charles Van Neste
Oral

Cost Effective Analysis and Experimental Design for an Axial Flux Motor Core Assembly

The objective of this research experiment is to understand the efficiency difference between an axial flux motor with a steel core and one with a core made up of magnetic PLA. Along with efficiency, cost is also analyzed to find out if magnetic PLA could ever be a successful alternative solution. For this experiment, an axial flux motor core was constructed and assembled based on the blueprints provided by

and the other magnetic PLA. After tedious coil winding, we hope to find and a difference in each of the mutual inductances with however still being able to output an efficient power and induced voltage.

8. Pierre Zakaria
Junior
Biomedical Engineering
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