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36th Annual Student Research Forum Abstract Booklet

University of Memphis Graduate School

Helen Hardin Honors College

University of Memphis Graduate Student Association

Monday March 25

36th Annual Student Research Forum

University Center Ballroom

Hosted by the Graduate School, Helen Hardin Honors College and the Graduate Student Association.

For more information, please visit:
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March 25, 2024

Dear Students:

On behalf of everyone at the University of Memphis, I want to offer my congratulations on your participation in the Annual Student Research Forum. I appreciate your abilities and the exceptional effort you have put forth to complete thoughtful, well-designed and thorough research studies.

It is through inquiry that discoveries are made so that knowledge from those discoveries can be shared with the world. I hope you found your experience enlightening, and that you continue to make discovery a part of your professional and personal life, no matter your discipline.

The University of Memphis, an R1 institution by the Carnegie Classification of Institutions of Higher Education, focuses on basic and applied research that directly benefits our city and the Mid-South region while also reaching beyond our state and local boundaries. Your continued pursuit of research and the presentation of your results in regional and national forums brings honor and recognition to the University. Those efforts do not go unrecognized, and we are proud that you are a Tiger.

Sincerely,

Bill Hardgrave
President

March 25, 2024

Dear Student Researchers,

Thank you for contributing to the 36th Annual Student Research Forum. It is our pleasure to attend this event and learn of the interesting research our students are doing. One of the most critical goals of higher education is to encourage intellectual inquiry and critical thinking. Research provides significant hands-on experience in these areas as you've discovered in your own projects. Whether you pursue a research-related career or not, the skills you have learned in carrying out your projects will serve you well. Research skills are valuable life skills in our increasingly information-rich world. The ability to define a question, to collect and organize information relevant to that question, and to evaluate and ultimately use the new knowledge will be useful in many facets of your lives.

Congratulations on your achievements. Your project is a testament of your hard work, determination, perseverance, and commitment, and a monument to the dedication of your faculty mentors. We hope you enjoy this year's research forum and wish you continued success.

Sincerely,

Deborah Tollefsen, Ph.D.
Vice Provost and Dean of Graduate School

Melinda Jones, Ph.D.
Director, Helen Hardin Honors College

March 25, 2024

Dear Judges,

On behalf of all those involved in organizing and presenting this year's Student Research Forum, and on behalf of the students participating in this year's event, I'd like to thank all of you for giving so graciously of your time and expertise.

The judges for this forum come from a wide variety of disciplines and scholarly traditions. One of the advantages of an event such as this is the opportunity it provides for students to interact with faculty and gain valuable feedback on their projects. Hopefully this experience will also be beneficial to you by providing you with exposure to the wide range of interests pursued by students at The University of Memphis, and by giving you a preview of the future of your respective fields and disciplines.

Again, thanks to each of you for participating in this year's Student Research Forum. Without your cooperation, support, and enthusiasm, our students would miss a wonderful opportunity to interact with and learn from the highly skilled faculty here at The University of Memphis.

Sincerely,

Deborah Tollefsen, Ph.D.
Vice Provost and Dean of Graduate School

Melinda Jones, Ph.D.
Director, Helen Hardin Honors College

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UNDERGRADUATE ABSTRACTS

EDUCATION

The Analysis of Levels of Metacognition in General Biology Students

Erika Kim, Anna Foreman (*Biology)*

Instructing biology students in metacognition is critical for cultivating scientific reasoning and self-reflection. Our previous research indicates that students may differ in their level of engagement in metacognition. Further characterizing these differences in metacognitive engagement may aid instructional techniques. In Spring 2024, we surveyed General Biology I students on their study habits, how they measure understanding, and how they respond to challenging topics. Using this data, we refined a method our lab developed for characterizing level of engagement in metacognition. We will present our findings, as well as ways we are utilizing this information to improve our metacognitive instructional practices

ENGINEERING

3D printing of bio-scaffolds utilizing a novel combination of acoustic-controlled microbubbles with digital light processing

Blake Acree (*Mechanical Engineering)*

Biological scaffolds are a micro-scale porous architectural structure designed to provide support and facilitate transportation of nutrients for the growth of new tissues in biological systems. There exists a challenge to preparing high-resolution porous materials that can effectively promote tissue regeneration. Combating this, we have developed an innovative method called Acoustic-controlled Microbubbles with Digital Light Processing 3D printing (AMDLP). This novel approach integrates DLP 3D printing with the microfluidics generation of microbubbles comprised of a biocompatible hydrogel with a photoinitiator. The microbubbles are patterned with acoustic waves during the photocuring process, enabling the creation of various scaffold structures. This new AMDLP method shows great potential to advance research into porous biological scaffold development and widely apply it in various biomedical fields, such as tissue regeneration, drug delivery and disease modeling.

Advancements Towards the Development of a Practical Ultrasound Body Scanner

Vincent Chenier (*Biomedical Engineering)*

Ultrasound is a popular diagnostic medical imaging modality due to its safety, speed, and cost-effectiveness, but its image quality is highly variable and operator dependent. This project aims to create an ultrasound body scanner capable of producing quantitative, volumetric, cross-sectional images of the torso with comparable quality to CT and MRI. Piston transducer and hydrophone fixtures were designed and 3D printed to aid characterization measurements and a mechanically swept-aperture setup. A multi-static synthetic aperture acquisition routine is being developed on a Verasonics research ultrasound system to facilitate phantom data acquisitions with a body-scanner prototype.

Honors Thesis: Transducer and Transcranial Ultrasound Characterization for Acoustic Window-Finding

Taylor Christian (*Biomedical engineering)*

Transcranial ultrasound can investigate brain structure and function, but locating an ideal 'acoustic window' to minimize degrading effects from inhomogenous skull bone proves challenging. In this study, we first aim to simulate the ultrasound beam from 0.5-MHz and 1.0-MHz piston transducers using Field II. Hydrophone measurements are then taken of each transducer's beam profile (with and without a temporal skull sample in the path of the beam) to compare with simulation and find the skull's ideal acoustic window. These results will inform the design of a transcranial array probe for rapid detection of severe stroke.

Characterization and Evaluation of 2CP-loaded Hydroxyapatite Coupons for Biofilm-Associated Infection Prevention

Yamekia Fair (*Biomedical Engineering)*

Local drug delivery is advantageous for complex wounds, especially those with local vasculature damage. Hydroxyapatite (HA), a natural biomaterial, can be used as a local delivery system due to its biocompatibility and porosity. Infections, a common issue for implant patients, can be further complicated with biofilm development. 2-heptylcyclopropane-1-carboxylic acid (2CP) is a medium chain fatty acid with evidence of structural stability, cell compatibility, and antimicrobial activity. In this project, the loading and release of 2CP from HA when applied using a simple immersion technique was evaluated by multiple methods to create a hydroxyapatite delivery system for fatty acids that will combat biofilm-associated infections. Wound care, especially in areas with little access to high quality tools, requires prioritization of infection prevention and wound coverage. For this study we evaluate the performance of a biomaterial chitosan membrane loaded with a biofilm-dispersing agent, 2-heptylcyclopropane-1-carboxylic acid (2CP). High performance liquid chromatography (HPLC) was used to evaluate results of elution tests. Percentage growth of bacteria in both the planktonic and biofilm growth phases were evaluated for unloaded and loaded HA. Visual evaluation of biofilm inhibition was conducted through scanning electron microscopy (SEM) imaging. In this case, inhibition was confirmed by a visual reduction of bacterial growth on the biomaterial, as well as quantified by percentage of bacteria coverage.

Solar Induced Fluorescence (SIF) Measurement via a Spectrometer and the Fraunhofer Line Depth Method

Angelin Favorito (*Herff College of Engineering, Electrical and Computer Engineering Department)*

Solar-Induced Fluorescence (SIF) is a byproduct of plant photosynthesis that can be used to assess vegetation health. It is difficult to observe due to background solar radiation. Utilizing solar "blind" spots or Fraunhofer lines, this study aims to measure SIF at spectral resolutions below 1nm. Several experiments were conducted on a sample of extracted chlorophyll, a live spider plant, and grass. The chlorophyll sample showed a distinct spectral profile of chlorophyll fluorescence, while Fraunhofer Line-Depth calculations measuring infillings at the O2 absorption bands showed that SIF contributed to total observed plant reflectance. Methods for remote sensing of SIF are discussed.

Evaluation of Glutaraldehyde Crosslinking Time on Chitosan-Gelatin-Elastin Electrospun Copolymer Membranes for Skin Wound Healing

Steven Go (*Biomedical Engineering)*

Incorporation of collagen and elastin in electrospun chitosan copolymer membranes (ECCM) improves bioactive and mechanical properties. These membranes, however, begin to lose their fibrous structure due to swelling when introduced to aqueous environments. Crosslinking ECCMs can reduce fiber swelling, but further elucidation of crosslinking parameters could provide opportunities for further optimization. This study looked at the effect of crosslinking time on ECCMs and evaluated these scaffolds' biocompatibility and mechanical behavior. Characterizations of ECCMs included FTIR, swell ratio tests, in vitro cell viability, and tensile testing.

Hybrid Angular Spectrum Ultrasound Simulation Method for Inhomogeneous Tissue Media

Estefania Guerrero (*Biomedical Engineering)*

The Hybrid Angular Spectrum (HAS) method can be used to calculate ultrasound wave propagation through inhomogeneous tissue geometries, providing fast and accurate results. Volumetric matrices of sound speed and attenuation distributions, and a planar incident pressure pattern, are given as input, and the pressure wave propagation pattern is calculated plane-by-plane, alternating between the space domain and the frequency domain for each slice of the volume. This study aims to implement the HAS method on MATLAB to help reconstruct inhomogeneous 3D models of the temporal skull, to identify ideal acoustic windows for transcranial ultrasound and inform custom array probe design.

Simulation of a Novel 2D Array Transducer Design for Transcranial Doppler Signal Acquisition

Farraday Johnson (*Biomedical Engineering)*

Acquisition of transcranial doppler (TCD) ultrasound signals is challenging due to the need to find an acceptable acoustic window through the skull and intersect the beam with the middle cerebral artery. We investigated the design of a novel 2D array transducer intended to interrogate skull thickness and allow steerability of the ultrasound beam to facilitate TCD signal acquisition. Field II was used to model multiple 2D array geometries using triangular transducer elements inscribed within a 2 cm diameter circle. The results obtained suggest that a simplified 2D array transducer could be made to provide TCD users with feedback to aid optimal signal acquisition.

Polyethylene Immersion in Royal Jelly's 10-Hydroxy-2-decenoic-acid Imparts Potential Antimicrobial Properties

Elizabeth Matlock-Buchanan (*Engineering)*

Polyethylene, or PE, which is used to make medical consumables, food containers, and implants, is prone to contamination by microorganisms through attachment and formation of biofilm colonies. To study how PE may be protected from contamination, the polymer was immersed in 10-Hydroxy-2-decenoic-acid (10-H2DA), an antimicrobial saturated fatty acid found in Royal Jelly, at 10 mg of therapeutic to 1 mL of ethanol. Initial results in FTIR and Contact angle characterization analysis show that the 10-H2DA therapeutic was successful in surface functionalization of the PE, suggesting further use in antimicrobial biomedical applications.

Electro spun chitosan membranes may relieve pain and prevent infection in burn wounds.

Lan Ngo (*Biomedical Engineering)*

Burn wounds are common to the military and civilian population, often in time in areas where proper medical attention is not possible. We hypothesized that acylated electro spun chitosan membranes (ESCM) loaded with anesthetic and biofilm inhibitors will manage pain. We observed rats that have undergone comb scald wounds and treated with dressings were assessed for pain based on facial landmark using the rat grimace scale. Based on the rat's grimace score we would assess the effectiveness of the ESCM compared to comparable field burn wound treatment.

Evaluating Biofilm-Related Infection Prevention of Chitosan Membrane Loaded with 2CP

Sophie Nieder (*Biomedical Engineering)*

Wound care, especially in areas with little access to high quality tools, requires prioritization of infection prevention and wound coverage. For this study we evaluate the performance of a biomaterial chitosan membrane loaded with a biofilm-dispersing agent, 2-heptylcyclopropane-1-carboxylic acid (2CP). High performance liquid chromatography (HPLC) was used to evaluate results of elution tests. Percentage growth of bacteria in both the planktonic and biofilm growth phases were evaluated for unloaded and loaded HA. Visual evaluation of biofilm inhibition was conducted through scanning electron microscopy (SEM) imaging. In this case, inhibition was confirmed by a visual reduction of bacterial growth on the biomaterial, as well as quantified by percentage of bacteria coverage.

Fabrication of Immunomodulatory Small-Diameter Vascular Grafts via Manuka Honey Incorporation into Touch Spun Biomaterials

Adeline Nordmoe (*Biomedical Engineering)*

Cardiovascular disease is a leading cause of death and global health problem, classified by blood vessel obstruction Surgical implantation of either autologous or synthetic grafts serve as a treatment method to replace damaged vessels. The goal of this study is to create synthetic bioresorbable touch-spun grafts that can hold their shape in the body. A custom-built touch spinning device produces the vascular grafts. The fibers collect on the mandrel of the spinner are at specified angles in order to replicate the environment of the extracellular matrix. Manuka honey is added to the solution for its antibacterial and anti-inflammatory properties.

Investigating the use of the Plug-and-Play Method in solving the 2D-SIM Inverse Imaging Problem

Rosalia Nwaobi (*Electrical and Computer Engineering)*

Plug-and-play (PnP) is a method that employs deep learning techniques in solving inverse imaging problems. We are investigating the use of PnP in Structured illumination microscopy, based on a two-dimensional (2D) illumination pattern (2D- SIM). Within the PnP algorithm a trained denoiser, such as the DnCNN and BM3D can be used for both noiseless and noisy simulated data. We employ the PnP-ADMM framework available in SCICO, a python package, which permits the alteration of parameters that control data fidelity and denoiser penalties. For different parameters, we observe the resulting output restored image and we compare the results in both spatial and frequency domains to ascertain the best output.

Quantifying Metabolites in Mice Tissue Samples with Varying Diets Using NMR Spectroscopy

Abdulla Obadat (*Biomedical Engineering Department)*

Glucocorticoids are some of the most common therapies for cancer treatment and inflammatory diseases and cases. However, with continued long-term usage, these glucocorticoids cause drastic side effects that are related to decreased metabolic rates and quantities. These side effects are known to drastically worsen with the addition of a high-fat diet (HFD). This project examines the effects of chronic glucocorticoid usage (dexamethasone injection) alongside fatty diets in mice populations through the analysis of metabolites with the usage of Nuclear Magnetic Resonance Spectroscopy. This project has just initially started and does not have a set of results yet. We aim to analyze the metabolic environment of various body tissues (mostly liver) associated with metabolic activity and play an active/ or passive role in metabolism. From these results, we hope to understand more about how lifestyle choices such as diet can influence the effects of chronic glucocorticoid treatment.

Using ImageJ to Deblur, Denoise, and Crop Fluorescence Microscopy Images

Chinonso Okoli (*Electrical and Computer Engineering)*

We use microscopy to make the invisible visible – that is, to see great detail in tiny three-dimensional objects. However, microscopes often output blurred images because they cannot focus on the entire 3D object. To solve this issue, we use ImageJ, a scientific image-processing software program, to obtain a restored final image from the raw data. Its various functions and plugins were used to process data and conduct simulations; we performed deconvolution, noising, denoising, cropping, and stitching on test datasets. We replicated and reversed the microscopic imaging process and obtained an output image that better resembles the underlying subject.

A low cost, semi-autonomous phenotyping cart for late growth stages of tall crops

Joseph Perry (*Mechanical Engineering)*

Traditionally, unmanned aerial systems (UAS's) have been the primary choice for phenotyping crops, but these systems are limited in endurance, power, payload, and legality. Medium to large, unmanned ground vehicles (UGV's), however, are not hampered by these limitations. Previous research in the application of phenotyping UGV's for tall crops has been focused on either small systems or very large gantry systems. Described here is a medium sized, low-cost, adjustable UGV that provides a solution by demonstrating the capability to image tall crops into late growth states. The UGV's capabilities are analyzed theoretically and practically, including its structural rigidity, handling, and endurance.

A bioactive Chitosan-Xylan Composite Loaded with and delivering naturally occurring Fatty Acids to Control Infection

Pavel Qaladize (*Biomedical Engineering)*

A chitosan-xylan composite has previously been shown to promote bone and tissue repair in a subcutaneous and a tibia fracture model. To extend the utility of the composite, it was loaded with a naturally occurring fatty acid, 10-Hydroxy-2-Decanoic Acid (10HDA), and an unsaturated fatty acid, cis-2-Decanoic Acid (C2DA), both being characterized as biofilm dispersing agents. With both fatty acids, the composite displayed a burst release of the fatty acids in a release study, analyzed by high-performance liquid chromatography. When testing for antimicrobial effectiveness, the composite showed antimicrobial efficacy when loaded with C2DA and no antimicrobial effects when loaded with 10HDA.

In Vitro Characterization of Crosslinked Electrospun Chitosan-Copolymer Membranes for Skin Wound Healing

Blake Robinson (*Biomedical Engineering)*

Chitosan's inherent anti-inflammatory, biodegradability, and anti-bacterial properties are attractive for a variety of applications including bone regeneration, wound healing, and many other tissue engineering applications. Previous work has shown that the incorporation of elastin, another natural polymer, improves the biocompatibility of electropsun chitosan nanofiber membranes (ESCM) for skin wound healing but are prone to fiber swelling. This work explores incorporating gelatin and elastin into ESCMs and the usage of two crosslinkers (glutaraldehyde and glyoxal) to prevent fiber swelling. Characterizations include swell ratio, fiber morphology imaging, and in vitro cell viability with fibroblasts.

Analyzing the Levels of Traffic Stress in the Memphis Metropolitan Area

Eleanor Scott (*Civil Engineering)*

This study utilizes Geographic Information System (GIS) to assess levels of traffic stress (LTS) within the Memphis area to identify solutions to improve pedestrian and bicycle safety. The methodology involves analyzing data on traffic patterns and high-risk areas specific to infrastructure for pedestrians and bicycles. A literature review was pursued to explore preexisting practices to identify current best options. The results will be used to detect challenges for improving infrastructure and reducing LTS in Memphis. This study has potential to contribute to the advancement of safety measures by providing insights into challenges and reducing traffic stress for vulnerable road users.

Transcranial Magnetic Stimulation Parameters Effect The Induced E-Field and Volume of Activated Cortical Tissue

Jalyssa Smith (*Biomedical Engineering)*

Transcranial magnetic stimulation (TMS) is a noninvasive procedure that utilizes magnetic fields to study brain function, diagnose, and treat neurological diseases. This study investigates the effect of TMS coil location, type, and orientation on induced E-field and volume of activated tissue. SimNIBS, an open-sourced platform, simulated three coil types and orientations, targeting the primary somatosensory cortex. Within the same hemisphere, E-field and volume of activation differed up to 10% and 35%, respectively. Coil orientation altered E-fields up to 11%, and volume of activation by 30%. An inverse relationship was observed between the volume of activation and magnitude of TMS-induced E-field.

Mechanical Characterization of Near Field Electrospun Fiber Alignment Angles for Bioresorbable Vascular Grafts

Alexandra Snyder (*biomedical engineering)*

Cardiovascular disease, characterized by the thickening of arterial walls, is the leading cause of death worldwide. Treatments involve surgical implementation of autologous or synthetic grafts to replace diseased tissues. The goal of this study was to fabricate and mechanically characterize near field electrospun bioresorbable vascular grafts that mimic the arterial extracellular matrix. Mechanical properties of the different fiber structures were compared to native vessel properties through longitudinal and circumferential uniaxial mechanical testing, suture retention, and burst pressure. The results demonstrated that the 15° templates were closest to mimicking the native vessel properties, though neither template design achieved all target values.

LIFE AND HEALTH SCIENCES

The Impact of Sex and Diet on the Development of Metabolic Syndrome

Stephanie Bigham (*College of Health Science)*

Introduction: There are many different diets that may contribute to the development of metabolic syndrome. Metabolic syndrome is a cluster of conditions that increase a person's risk of cardiovascular disease. One aspect of metabolic syndrome is insulin resistance, which affects 7.3% of males and 6.6% of adult females. Muscle comprises 40% of the average body mass and helps to control insulin sensitivity. Purpose: The purpose of this experiment was to determine how different diets alters the progression of insulin resistance in males compared to females. Methods: Mice were fed one of three diets; control (20% fat, 20% protein, and 60% carbohydrates (18% sucrose), High Fat (45% fat, 20% protein, and 35% carbohydrates (18% sucrose), or High Sugar (60% carbohydrates (60% sucrose), 20% protein, and 20% fat. Glucose tolerance test was conducted at 0 weeks, 6 weeks, and 12 weeks. Fasting insulin was measured in a subset of animals at weeks 6 and 12, and HOMA-IR was calculated. RNA was isolated from the skeletal muscle and RT-PCR was run for Gult4 and Igf1 genes. Result: The male high fat diet group at 12 weeks had higher insulin, blood glucose, and HOMA-IR compared to all other groups. HOMA-IR was elevated in the HF males at 6wks, while no change was seen in the HS or female groups. There was no difference in gene expression of Gult4 and Igf1. Conclusion: These data suggest that females may be protected from insulin resistance regardless of diet, and it may be regulated independently of muscle Glut4 and Igf1 expression.

Investigating Packera cymbalaria and Packera heterophylla (Asteraceae) using morphology data

Paris Fouche' (*Biological Sciences)*

The genus Packera within the sunflower family is distributed across North America, with only one species, Packera heterophylla, found in Russia. This species shares similar characteristics to Packera cymbalaria, which can be found in Alaska and Canada, causing some botanists to believe they are the same species. In this project, herbarium loans were used to analyze the species' morphological characteristics. These data were used to compare the two Packera species as well as understand the differences and similarities between these species across different locations. This study found that Packera cymbalaria and Packera heterophylla are likely the same species.

Modeling the Progression of Diabetic Retinopathy Using the BXD79 Mouse Strain

Jazz James (*College of Health Sciences)*

Diabetic retinopathy (DR) is a microvascular disease associated with diabetes mellitus complications. The alterations in blood flow and vasodilation accompanying the erratic changes in blood sugar associated with DR can affect the vasculature and neurons of the retina, resulting in blindness. Utilizing animal models elicits a better understanding and permits further investigation of the genetic, cellular, and molecular mechanisms of multiple retinal degenerative diseases observed in humans. However, diseases with complex etiologies such as DR, can be difficult to model in animals often requiring initiating the disease state with some form of insult such as streptozotocin treatment to kill pancreatic islet cells. We have uncovered a naturally occurring, spontaneous model of DR, the BXD79 mouse, which displays phenotypes of high blood sugar, obesity, vascular leakage, cataracts, and retinal degeneration. This study seeks to investigate the etiology and pathology of DR in the BXD79 model. BXD79 and age-matched C57B/6J controls underwent retinal functional examinations including electroretinograms (ERG), optokinetic nystagmography (OKN), optical coherence tomography (OCT), and funduscopy/fluorescein angiography (F/FA) every 3 months beginning at 6 months of age until 18 months. ERGs reveal improper retinal function by 9 months denoted by the reduction in a-wave and b-wave amplitudes and continue to diminish until 18 months. Reduction in visual acuity and contrast sensitivity observed by OKN also indicate visual function abnormalities. Additionally, retinal thinning including regions of the photoreceptor layers and the nerve fiber layer was observed by OCT while exudative vasculature also began at 9 months and progressed through 18 months as observed by F/FA.In summary, this spontaneous model of DR contributes to a deeper understanding of the etiology and pathology of this disease when examining the related phenotypes, blood vessels, and neurons of the retina. Functional examination results suggest a progressive reduction in retinal function, and disruption of retinal and vascular integrity from 9 to 18 months. Despite DR being a complex disease to model, further exploration into its mechanisms using the BXD79 model may aid in advancing therapeutic interventions for humans.

Examination of the Role of MAPK Activity on Placental Formation in Vitro Using Stem Cells

Calvin Robinson (*Department of Biological Sciences)*

Mitogen-activated protein kinase kinase kinase 4 (MAP3K4) phosphorylates and activates several MAP2K (mitogen-activated protein kinase kinase) enzymes, including MAP2K3, MAP2K4, MAP2K6, and MAP2K7. Upon activation, MAP2K3/6 phosphorylate p38, MAP2K4/7 phosphorylate JNK, and MAP2K1/2 phosphorylate ERK. We hypothesized that the activation of these enzymes promotes placental and fetal maturation, prompting examination of these pathways. This study investigated wild-type and MAP3K4 kinase-inactive mouse cells in vitro in multiple biologically independent experiments. Trophoblast stem (TS) cells were treated with either DMSO (-) or 3 μM of CHIR 99021 for 96 hours. We measured the activity of p38, JNK, and ERK using polyacrylamide gel electrophoresis and Western blotting. We found that the p38 and JNK mitogen-activated protein kinase (MAPK) pathways were induced during differentiation of wild-type TS cells to SynT-II cells. In contrast, activation of the ERK MAPK pathway was reduced upon differentiation. MAP3K4 kinase inactivation resulted in a failure to activate JNK or p38 MAPKs and the inability to form SynT-II cells. Together, these data suggest a key role for MAP3K4 activation of JNK and p38 in the formation of the SynT-II cells of the placenta. Future studies will assess the activation of MAPK signaling in vivo during placental development.

Transgenerational maternal effects on cold adaptation in the Drosophila melanogaster

Elmira Umarova (*Department of Biological Sciences)*

Our research investigates how ectotherms such as insects cope with temperature fluctuations, focusing on transgenerational adaptations in Drosophila melanogaster. We discovered that offspring of mothers raised at colder temperatures showed improved cold shock recovery, suggesting maternal temperature experiences influence offspring cold adaptaions. By genetically manipulating the mother's temperature-sensing neurons, we found that disabling heat-sensing neurons, but not cold-sensing ones, enabled cold adaptation in offspring making heat-sensing essential factor in induced cold adaptation regulation. This indicates that maternal perception of temperature actively regulates offspring's cold tolerance, highlighting a sophisticated mechanism of environmental adaptation.

PHYSICAL AND APPLIED SCIENCES

Computational Studies of Screening Potential Molecular Bonds with Uranium Hexafluoride Utilizing Computer Software

Gianna DeLisio (*Biomedical Engineering)*

A surplus of uranium hexafluoride waste exists with no known use. Utilizing computational chemistry, functional groups that contained only nitrogen than groups with nitrogen and oxygen or oxygen alone had a higher intermolecular binding energy with uranium hexafluoride. Ultimately, uranium hexafluoride's octahedral geometry tended to prefer to bond with nitrogen's, rather than oxygen's, lone pairs. The IBEs between uranium hexafluoride and functional groups depend on how the functional group causes deformation in the octahedral geometry of uranium hexafluoride. The larger the angular deviation caused by a functional group led to a greater IBE.

Improving the Construction of QM Cluster Modeling using FSAPT Interaction Energies

Zaid Hadidi (*Chemistry)*

The focus of the DeYonker lab is the design and application of computational enzymology, specifically using Quantum Mechanical-cluster models. My project utilizes the chorismate mutase enzyme as a case study and extends the results of qualitative contact-based Residue Interaction Networks (RINs) with quantitative interaction energies from functional group symmetry adapted perturbation theory (F-SAPT). We analyzed various types of QM-cluster models from F-SAPT interaction energies based on how far away the amino acid fragment is from the substrate. Additionally, we are studying how the energy decomposition of F-SAPT into electrostatic, induction, and dispersion terms is correlated with the residue fragment distance from the TSA.

The Impact of AGN Feedback in the Formation of Milky-Way Like Galaxies

Joseph Zeron (*Physics)*

We examine the impact of Active Galactic Nucleus (AGN) feedback driven by Supermassive Black Holes (SMBH) on the evolution of a Milky Way-like Galaxy. We do this by running the simulation jsAGN2(joseph AGN 2), using the Smooth Particles Hydrodynamics code ChaNGa, and comparing it to the simulation MUGS2(McMaster Unbiased Galaxy Simulations 2). The MUGS2 simulation includes only Supernovae feedback, while jsAGN2 also includes AGN feedback. This reveals the SMBHs' effects on the evolution of a Milky Way-like galaxy. We observed how the star formation rate was affected by both forms of feedback and compared the gas properties in these simulations.

SOCIAL AND BEHAVIORAL SCIENCES

Examining the Effects of Social Hierarchy on Social Reward Preference in Mice

Maryam Al Azzawi (*Psychology)*

While social interaction is generally thought to be rewarding, social withdrawal and avoidance are key symptoms in many psychiatric disorders such as autism spectrum disorder, social anxiety, depression, and substance use disorder. Insight on the factors that contribute to variations in social reward behaviors is fundamental, and one such factor may be social hierarchies. Demonstrated by humans and animals, social hierarchies are used to determine resource access, health, and ultimately survival. The proposed study examined the effects of social hierarchy on social reward preference in male and female C57BL6/J mice (n = 10 per sex). The social dominance tube test was used to determine the social hierarchy of pair-housed mice (socially dominant vs submissive). Social conditioned place preference (CPP) was used to determine social preference. Social CPP consisted of 10 days, with an initial Day 1 chamber preference test, followed by 8 days of conditioning (alternating between conspecific social interaction and isolation). On Day 10, another chamber preference test was conducted, and social preferences was calculated as the time spent in the social-paired side on Day 10 minus Day 1. A two-way between subjects ANOVA was used to determine the effect of sex and social hierarchy on social preference. There was a significant main effect of sex, with females displaying more preference for social interaction than males. There was a significant main effect of social hierarchy, with socially dominant mice displaying more preference for social interaction than submissive mice, and the interaction between sex and social hierarchy was significant, indicating that social hierarchy had a larger effect on social preference in females. Dominant females displayed a greater preference for social interaction compared to all other groups. Understanding the sex-effects of social hierarchy on social preference/aversion may help improve treatments for social deficits and inform researchers working with pair-housed mice.

Study on Observer's Perceptions of a Therapist Taking Notes During a Session

Mackenzie Austin (*Psychology)*

This study attempted to further the research on whether a therapist taking notes during a therapy session affects the perception of therapist factors. Notetaking is often a part of therapy, yet there are few studies on how it affects therapy. The available studies each reach different conclusions on the effect of notetaking on perceptions. The current study attempted to determine if perceptions of credibility, expectancy, and empathy are affected by therapist notetaking. Videos of graduate student therapists were paired with audio from APA therapy sessions to provide an authentic therapeutic experience. The data has been analyzed with a two-factor between subjects ANOVA. The results have been used to make inferences on how notetaking affects client perceptions. The results provide information on if the therapist's notetaking affects how observers perceive psychotherapy factors.

The Association between Impulsivity and Diabetes-Specific Microaggressions among Youth Diagnosed with Type One Diabetes

Ressie Carr, Audrey McDonnell (*Psychology)*

This study examines the association between diabetes-specific microaggressions (DIABMA) and impulsivity among youth with type 1 diabetes (T1D). 105 youth with T1D, 12-18 years (Mage=14.62±2.01 years), completed the diabetes-specific microaggressions survey. Participants were assigned cost discounting (CD) scores. Discount rate (k) was applied to approximate impulsivity. We hypothesize a positive correlation between discount rate and DIABMA. Participants (44.7% White, 41.7% African American, 13.6% Latinx or mixed-race), high in impulsivity (high CDk scores), reported more DIABMA (r=-0.211, p<0.034). Future studies should explore the relationship between impulsivity and glycemic health. Present findings highlight the importance of addressing DIABMA in youth with T1D.

Socio-Ecological Factors Related to the Development of Hypertension in College Students: A Literature Review

Andrea Cervantes-Abraham, Noor Amro (*Loewenberg College of Nursing)*

College students with adequate knowledge of their behavior changes are less likely to develop hypertension later in life. The purpose of this review is to examine personal, interpersonal, and environmental factors that can contribute to the likelihood of developing hypertension among college students. A comprehensive literature search was performed. Results show that college students with poor nutritional knowledge, a high BMI, and a sedentary lifestyle are positively associated with a higher risk for developing hypertension in the future. Increasing knowledge of nutritional wellness and awareness about health behaviors among college students can reduce their risk of developing hypertension in the future.

"Examining the Relationship between Childhood Trauma and Aggressive Behavior in Children"

Mia Chambers (*Psychology)*

Experiencing childhood trauma may contribute to aggressive behaviors in children. Parenting practices could also impact aggression. The current study examined these relationships among 98 parent-child dyads. Children (Mage=7.52, SD=3.30; Black=89.8%) and parents (Mage=35.35, SD=9.70; Black=91.8%) were recruited from community organizations in Memphis. A linear regression model (F(7,90)=5.70, p<.001, R2=.307) indicated that more childhood trauma (B=.980, p=0.029), more use of alternative discipline strategies (B=.684, p=.015), and less parental involvement (B=.591, p<.001) were related to higher aggressive behavior. Findings suggest that trauma-informed parenting practices that prioritize positive discipline methods (e.g., positive redirection) and parental engagement may reduce aggression in trauma exposed youth.

Examining Factors That Influence Social Reward via Conditioned Place Preference Testing

Christopher Higgins (*Psychology)*

Identifying patterns in social behavior are key elements when studying and diagnosing psychiatric disorders. Deficits in essential elements of life, such as socializing, are fundamental when addressing the effects of a given psychopathological diagnoses. Further characterizing changes in social interaction brought about from a neurodevelopmental and psychiatric disorder, may play a role in faciliating more productive growth in the area. This study was designed to examine social reward preference, while may also play a significant role in determining the quality of social interaction. Additional research in this area serves to further develop treatments for these often debilitating psychiatric disorders.

Yoga Practice on Management of Blood Pressure in Adults with Hypertension: A Literature Review

Jack Huynh, Chaela Pejo, Macie Cotham (*Nursing)*

Hypertension affects nearly half of adults in the US, leading to increased risk of stroke and heart disease. Yoga is a physical and spiritual practice that may be effective in managing hypertension by promoting stress reduction and physical activity. The purpose of this project is to review the effectiveness of yoga among adults with hypertension. A literature search was performed to identify research articles from 2019-2024. A total of five studies selected for this review implemented yoga intervention and compared blood pressures before and after the intervention. These studies suggest yoga may be an effective strategy for hypertension management.

Unveiling the Path to Self-Compassion: Exploring Implicit Theories and Growth Mindset

Maria Le, Blake Robinson (*Psychology)*

Guided by research on implicit theories, we tested implicit theories of self-compassion as a possible antecedent. A pilot study created the Implicit Theories of Self-Compassion Scale and showed that people who view self-compassion can grow over time versus is fixed reported more trait self-compassion. Two experiments found that people randomly assigned to read a passage that emphasized self-compassion can grow compared to being fixed, or to a control passage, reported higher state self-compassion growth mindset and, in turn, reported more state self-compassion. Self-compassion growth mindset is one factor that can foster greater self-compassion.

Technology-Based Interventions to Improve Behavior and Symptom-Related Outcomes among Adolescents with ADHD: A Literature Review

Tristan Pfeifer, Abigail Kyla, Doyle Stokes (*Nursing)*

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity. The purpose of this review was to examine the effectiveness of technological interventions on behavior and symptom-related outcomes for adolescents with ADHD. A comprehensive literature search is performed. We identified eight randomized controlled trials. It was determined that technological interventions were effective in reducing behavioral outbursts as well as symptoms and could be used as a first line of treatment instead of pharmaceuticals. The technological interventions were more effective, and they also overall had less negative side effects on the adolescents.

Revealing the Path to Self-Compassion: Exploring Implicit Theories and Growth Mindset

Blake Robinson, Maria Le (*Psychology)*

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Examining the Relationship between Dopamine Autoreceptor Functioning and the Dopaminergic Effect of Cocaine

Jamie Underwood (*Psychology)*

Autoreceptors regulate the amount of dopamine being released in the presynaptic terminal and stabilize the amount of dopamine in the synapse. This study aimed to determine how autoreceptor functioning is related to the dopaminergic response to cocaine. Mice were anesthetized with urethane (1.5g/kg) and placed in a stereotaxic frame. Fixed potential amperometry was used to assess dopamine autoreceptor functioning and dopamine release in the NAc. Mice were given an injection of cocaine (10 mg/kg, ip), and dopamine measurements continued for 1 hour. A pearson correlation showed a negative correlation between autoreceptor functioning and dopamine release post cocaine.

Technology-Based Interventions on Health Risk Knowledge and Perceptions of E-Cigarettes Among Adolescents: Literature Review

Xiaolei Wu, Angela Salta, Mikaela Zabaceda (*Loewenberg College of Nursing)*

E-cigarette use, also known as “vaping”, has been a rapidly emerging problem among adolescents. Recent findings have proved the negative health implications of e-cigarettes on brain development, addiction, and lung function. In this literature review, we aim to explore the effectiveness of technology-based interventions in changing e-cigarette knowledge and risk perceptions among adolescents. A comprehensive electronic database search was conducted with six primary articles identified. We found that technology-based interventions, especially virtual reality (VR) and videogames, significantly improved health risk knowledge and perceptions of e-cigarette harm with the potential to prevent future e-cigarette use by changing these risk factors.

GRADUATE ABSTRACTS

BUSINESS

Exploring the influence of social media influencers on Consumer Choices in Hospitality

Nelly Agyemang (*Kemmons Wilson School of Hospitality and Resort Management)*

The hypothesis for this study is that exposure to social media influencers promoting hospitality services has a statistically significant effect on ensuing hospitality-related consumer choices beyond pre-existing tendencies. Specifically, it is hypothesized that after viewing influencer content featuring dining establishments, accommodation properties, travel destinations or other hospitality services on major social media platforms, consumers exposed will be more likely to report intent or actually book and purchase the highlighted hospitality services compared to their pre-exposure preferences, controlling for pre-existing biases.

How do guest reviews influence the hotel selection process among customers?

Anastasia Baddoo (*Kemmons Wilson School of Hospitality and Resort Management)*

Guest reviews provide useful information on a property's quality, facilities, location, and overall experience. These reviews are mostly given by customers who have visited the hotel for different purposes, hence their reviews will be based on the kind of service rendered to them, sometimes too the hotels hire the services of online or product or service influencers to review them just to attract the desired target group. This study proposes that, guest reviews, whether negative or positive, significantly shapes customers perceptions, decision process, and the way they behave when selecting a hotel.

Can you get a job only with your personality and communication skills?

Sagar Charles (*Kemmons Wilson School of Hospitality and Resort Management)*

Soft skills are usually underestimated but are highly important for any industry and helps both in professional and personal development. The significance of doing this research is to determine if alone soft skills can stand out as it is a mix of both soft skills and hard skills that helps in the accomplishment of the task. This study proposes that if individuals actively cultivate and enhance their soft skills through targeted training and practice, then their ability to acquire and excel in hard skills relevant to their profession will improve.

The Impacts of Deepfake Valence and Rational Choice: A Double-edged Sword

Shao Chew (*Management Information Systems)*

Deepfakes have garnered widespread attention for their malicious use. Despite its infamy, deepfakes can bring forth a myriad of benefits. Given the controversies around deepfake, it is unclear why people adopt this technology for various purposes. Through the lens of rational choice theory, we develop a research model to explain deepfake adoption. From the perspective of deepfake developers, we categorize deepfake usage based on two dimensions: purpose (utilitarian vs. hedonic) and valence (benevolent vs. malevolent). Deepfake adoption is driven by a risk benefit analysis which, in turn, is influenced by socioenvironmental factors.

On Creating Diversity Organizations: A Congruence Model Perspective to Mitigate Discrimination

Darel Hargrove (*Management)*

Researchers have long attempted to resolve discrimination in organizations through diversity practices and equal opportunity initiatives. These efforts are even more salient when considering sixty years have elapsed since the enactment of the Civil Rights Act of 1964. In this conceptual model I draw from extant literature to introduce the Diversity Organization, a new perspective on mitigating discrimination in organizations. I use concepts of systemic congruence to (1) define what a diversity organization is; (2) identify the necessary components of the diversity organization; and (3) how these components influence individual outcomes and firm effectiveness.

How upgraded hotel rooms with modern furniture and décor will affect hotel performance?

Mayura Jain (*Kemmons Wilson School of Hospitality and Resort Management)*

This study's research topic is about how upgraded hotel rooms with modern furniture and décor will affect the profitability and ADR of a hotel. The proposed hypothesis is that guests will be willing to pay more per night, even though it is just $10 more per night for the upgraded and modern experience stay as compared to the neighboring hotel that has old décor and amenities.

Does disclosure of greenwashing affect the investing decisions of non-professional investors?

Sohee Kim (*Accounting)*

The growing need for environmentally-friendly products and the requirement for corporations to reveal their sustainability policies generate interest from professional and non-professional investors in Environmental, Social, and Governance (ESG) matters. More people are becoming aware of the "greenwashing" practice in which businesses make up their environmental friendliness. The study aims to examine the discerning of non-professional investors in differentiating authentic environmental projects from greenwashing and the subsequent impact on their investment decisions. Findings indicate that although they are able to recognize greenwashing, they have trouble understanding intricate situations, including in-depth ESG reports.

Facebook, Instagram, Twitter, or Tik-Tok: Which Platform Most Positively Impacts Boutique Hotel Bookings

Jennifer McCullough (*Kemmons Wilson School of Hospitality and Resort Management)*

Boutique hotels are described by their unique character, smaller size, personalized touch and individualized service. The unique nature of boutique hotels presents a challenge for traditional marketing channels. Social media has become a game-changer, revolutionizing the way hotels connect with their guests. Through social media, hotels can attract and engage with their target audience in real time giving their customers an authentic taste of the experience the property offers. Previous research does not address the impact of individual social media platforms. This study will examine the impact of Facebook, Instagram, Twitter, and Tik-Tok marketing on hotel bookings.

Child Access Prevention Law and Youth Firearm-related Homicides: A synthetic Control Approach

Babasoji Oyemakinde (*Economics)*

Despite legislation enacted to ensure secure gun storage and prevent unauthorized access to firearms by minors, youth firearm-related homicides remain a current public economic policy concern. Negligent storage provision of Child Access Prevention (CAP) law penalizes adults who store firearm in a manner that makes them easily accessible to minors. In contrast, reckless endangerment provision penalizes adults for knowingly or intentionally allowing minors access to firearms. This study focuses on the negligent storage aspect as it is hypothesized to have a stronger impact on firearm homicides. The study stands out in its use of 1984 to 2018 U.S state-level data from the National Vital Statistics System (NVSS) multiple cause of death file and employs a synthetic control empirical strategy. After incorporating state level covariates and lags of the outcome variable in constructing the synthetic control for each treated state, I find that states such as Texas, Connecticut, New Hampshire, North Carolina, and New Jersey would have experienced a higher incidence of youth firearm-related homicides, in the absence of CAP law. Policy implications of the findings will be explored.

EDUCATION

Data Analysis of the 2023 Shelby County Community Health Needs Assessment

Sushma Alla (*Public health epidemiology)*

The Shelby County Health Department conducted the 2022–2023 Community Health Assessment (CHA) Survey with the primary objective to comprehensively understand the health needs and concerns of Shelby County residents. The survey aimed to collect data on community health issues, public health priorities, and quality of life perceptions among residents. Drawing from community health assessments and literature reviews, the purpose was to identify disparities, gauge resident demographics, and pinpoint areas for potential intervention or improvement in health services and resources within the county.

An Evaluation Of Marginalized Student-Athlete Mental Health, Access To And Utilization Of Support Services

Ashely Boles (Education)

NCAA student-athletes (SAs) live a dual life that expects them to balance both academic and athletic demands while navigating transition into adulthood. SAs experience mental health concerns at similar rates to their non-athlete peers, and when left untreated may result in death by suicide. Employing Engel's biopsychosocial framework to explore interconnected factors, the primary purpose of this study is to evaluate the underrepresented and historically marginalized SA experience with mental health services with the intent to extend knowledge and understand SA access and utilization of mental health services. This presentation will discuss the research process and preliminary data.

Kindness doesn’t run a school”: Insights from a Kindergarten Science Curriculum Ethnography

Taylor Mule' (*Educational Psychology and Research)*

Access to high-quality science education in early childhood is an issue of human rights, social justice, and science education equity. We conducted an ethnography in a North Memphis kindergarten classroom implementing an infectious diseases curriculum to better understand how kindergartners make meaning of their world through science. We dive into the intricate interplay between curriculum implementation and school culture to shed light on the ways in which school climate expands and contracts a student's ability to learn. We observed that teacher turnover, parental dissatisfaction, and student absenteeism disrupted the learning process, ultimately leading to the termination of the curriculum pilot in the school.

Cultivating Change Agents: Ethnographic reflections from a middle school afterschool club

Robyn Pennella (*EDPR)*

Recent calls for education equity often involve increasing inclusion in the classroom. Calabrese-Barton and Tan trouble this notion of equity as inclusion by highlighting its lack of attention to systemic injustices that manifest in the classroom. They put forth the Rightful Presence Framework to rethink student empowerment in justice-oriented ways. The St. Jude Community Health Club is a middle school afterschool club that utilizes a rightful presence framework. An ethnographic study of the club revealed how the curriculum facilitated students to critically reflect on violence in their communities to position themselves as change agents.

Stereotypes in Science: Rasch Analysis of 5th Graders’ Scientist Drawings using the DAST-CR Checklist

Luke Walden (*CEPR)*

The Draw-a-Scientist Test (DAST) is a useful instrument to assess how a child conceptualizes their understanding of a scientist using drawings, specifically what scientists do and what they look like. The DAST checklist has been used in numerous studies and has seen multiple revisions, but additional validation is needed to ensure that raters apply the checklist in a consistent manner. We present the findings of a Rasch analysis of the DAST checklist using ratings from 12 trained raters for 72 drawings of 5th graders in the St. Jude STEM club.

Exploratory Qualitative Case Study of Early Childhood Curriculums, Play, and Social Interactions

Latetrica Wilson (*Professional and Liberal Studies)*

The purpose of the study aims to explore the factors affecting the effectiveness and adoption of play-based approaches such as Reggio Emilia and Montessori in enhancing development in early childhood education. The key focus is to better understand the consequences of neglecting play as a crucial element in early childhood education. Considering these aspects, the research investigates the essential disparities linked to play-based learning. The population under consideration will be kids in three different types of classrooms, including Reggio Emilia, Montessori, and voluntary pre-kindergarten. This study will target the three classrooms identified at the University of Memphis Barbara K. Lipman Early Learning and Research Center (ELRC) and Porter-Leath and the University of Memphis Early Childhood Academy at Orange Mound (PLUM).

ENGINEERING

Integration of Machine Learning in Structured Illumination Microscopy Restoration Using The Plug-and-Play Methods

Arash Atibi (*Electrical and Computer Engineering - EECE)*

The performance of Structured Illumination Microscopy (SIM), a computational imaging technique for achieving higher resolution, can suffer greatly while dealing with noisy data. Plug-and-Play methods allow the incorporation of different information including Machine Learning denoiser(DnCNN) in the process of image reconstruction. Nonetheless, we assume the proposed DnCNN denoiser has a limited impact on the output quality, as it is trained on Gaussian noisy data—SIM data usually contain Poisson noise. Thus, our team is investigating methods to incorporate the current denoiser in the reconstruction process or developing an ML denoiser trained on Poisson data.

Evaluation of environmentally friendly "green" fabrication of electropsun chitosan biomaterials for tissue engineering applications

Alex Bryan (*Biomedical Engineering)*

Chitosan has recently gained popularity as a polymeric biomaterial due to its inherent anti-inflammatory, anti-microbial, biocompatibility, biodegradability properties. Electrospinning is one fabrication technique that creates nanofiber membranes which are attractive for many tissue engineering applications. This process relies on harsh solvents, like trifluoroacetic acid (TFA), which are harmful to cells, the researcher, and the environment. Finding an alternative solvent and electrospinning protocol for chitosan eludes researchers, who instead rely on neutralization treatments to mitigate these harmful effects. This study seeks to establish a TFA-free, “green” electrospinning protocol for chitosan/chitosan-copolymer membranes to improve biocompatibility in tissue engineering applications.

Aerial Image feature mapping using for Remote Sensing Applications using Deep Neural Networks

S. Parisa Dajkhosh (*Electrical and Computer Engineering)*

This research focuses on the analysis of aerial imagery, specifically satellite and terrain images sourced from the Google Maps API. The primary objective is to develop a deep learning framework capable of discerning images taken from the same geographical location, leveraging common features present in both satellite and terrain imagery. This endeavor involves the utilization of transfer learning in a Siamese network to extract meaningful feature maps. Satellite and terrain images represent two distinct yet complementary facets of aerial imagery.

A New GIS framework for Characterizing Urban Basins in Water Resources Management Applications

Francesco Dell'Aira (*Department of Civil Engineering)*

The percentage of impervious area (IA) is a well-established measure of urbanization in hydrology, used for assessing the impacts of land development on water quality and peak flow generation. However, recent studies have pointed out the limitations of IA as a proxy for the hydrological effects of urbanization, because it is not able to account for the spatial arrangement of developed patches. To address this limitation, we introduce a connectivity-based urbanization index, derived from continuous digital watershed data. Results from three literature case studies indicate that this new index enhances flood prediction accuracy in ungauged basins.

Optimizing EV Charging Spots: A Smart Solution Inspired by Hummingbirds

Sravan Kumar Dumpeti (*Electrical and Computer Engineering)*

Optimal placement of EVCS (Electric Vehicle Charging Station) presents a significant challenge in the rapidly evolving domain of Electric Vehicles (EVs). To mitigate the adverse effects of EVs on the power system and EV owners themselves, choosing the right spot for deploying EV charger is paramount for eliminating the unfavorable consequences. Our research focuses on choosing the best spot to place EVCS using a smart strategy inspired by hummingbirds. The Artificial Hummingbird Algorithm is like natures GPS for EVCS. Making sure that the EVCS were in the right spots cuts down on energy waste and costs in the power system..

Project Title: Cyber Resilient 5G Enabled Electric Vehicle Charging Station

Elijah Durkee (*Electrical and Computer Engineering)*

The future of EVs is coming, and with this comes the need to charge these vehicles. Like many things in the modern connected world, our goal is the best connection and the best security. For this, we are developing a charging station designed to take advantage of the modern cellular connection, 5G, and to be resistant to a variety of cyber-attacks, which will help keep the public and its infrastructure safe. We are also incorporating wireless charging into the station to help provide an ease of use for the user.

Multivariate Adaptive Regression Splines Analysis in Predicting Earthquake-Induced Slope Displacements

Alireza Eskandarinejad (*Civil Engineering)*

A key challenge in developing regional seismic-induced landslide hazard maps is that the input data for the predictor parameters required to estimate the landslide displacement is limited or not available. In this regard, the primary purpose of this study is to investigate the potential application of Multivariate Adaptive Regression Splines (MARS) analysis to identify the most influential predictor parameters in the estimation of the earthquake-induced slope displacements. The MARS results with a reasonable coefficient of determination (R2) of approximately 90% indicate that the most influential parameters are Arias intensity, mean period of ground motions, and soil shear strength.

Acoustic Bubbles: Trapping, Patterning, Removal For Induced Cell Interactions

Jonathan Faulkner (*Mechanical Engineering)*

The study of cell-cell interactions is crucial to improve the understanding of biological issues and advance drug development. Recent microfluidic technology allows the performance of cell-to-cell interaction experiments on-chip, enabling the study of specific cell-cell interactions in a highly defined microenvironment. Acoustic bubbles are tiny bubbles that can be excited by an external acoustic source. The bubbles are clean, biocompatible, and an effective tool in manipulating fluids and particles at microscale. This research work focuses on generating, controlling, and removing acoustic bubbles in a microfluidic device to manipulate cells and induce the interaction between the cells.

Kinematic descriptors of deformation of ONH images for glaucoma progression detection

Fisseha Ferede (*EECE)*

In this work, to the best of our knowledge, we developed the first optical flow estimation based elastography kinematic descriptors of the optic nerve head (ONH) of the retina from multiple confocal images. These kinematic descriptors include strain descriptors and vorticity descriptors which are capable of capturing local deformation patterns in shape associated with tissue expansion and contraction as well as local rotations and spins, respectively, that jointly define the underlying deformation during progressive glaucoma. Our approach utilizes our recent multi-frame based optical flow estimation algorithm, SSTMs, which are capable of estimating highly accurate flow fields from multiple image sequences by understanding the sequence's space-time dependency. This flow estimates are used to approximate the deformation field based on which several elastography kinematic descriptors are developed. Our estimated elastography kinematic descriptors demonstrated exceptional performance in classifying ONH with progressive glaucoma from normal ONH on both the LEGS and DIGS datasets. Moreover, we introduce elastography based event analysis visualization tool that can capture tissue deformation related major events occurring in the ONH. This visualization tool has a big potential for diagnostic application in identifying localized tissue damages and relative rates of glaucoma progression from follow-up ONH scans.

Evaluating the effects of raspberry ketone on macrophage cytokine expression for guided bone regeneration

Samantha Hall (*Biomedical Engineering)*

Barrier membranes for guided bone regeneration (GBR) are used to segment regions of ossification from infiltrating soft tissues. Electrospun chitosan membranes (ESCMs) have shown promise for enhanced GBR through the local delivery of active compounds. Raspberry Ketone (RK) is a phenolic compound of red raspberry that possesses anti-inflammatory properties and has shown significant potential in the promotion of M2, pro-healing, macrophage polarization. This study aimed to evaluate the regenerative properties of RK when released from ESCMs in vitro. Microarray analysis was used to simultaneously evaluate the presence of 20 pro-inflammatory and anti-inflammatory cytokines in the culture medium, allowing for the characterization of macrophage cells.

Impact Mitigation of Simultaneous Electric Vehicle Charging on the Power Distribution Grid

Md Nahin Islam (*Electrical and Computer Engineering)*

Due to environmental concerns, conventional vehicles are being replaced with electric vehicles (EVs), and this tendency is expected to keep growing in the near future, which will have direct impacts on the distribution grid. Typically, EV owners charge their vehicles post-work, intensifying the grid's pre-existing peak load. As a result, power quality issues pop up in the distribution system. The purpose of this study is to evaluate the impact of simultaneous EV charging on a bus in the IEEE 9-bus power system. Also, a supercapacitor-based energy storage system will be proposed to mitigate this problem.

Innovations in Gap Prevention for Continuous Concrete Pile Wharves: Case Study of Anzali Port

Navid Joushideh (*Civil Engineering)*

The construction of wharves using continuous concrete piles presents challenges, including pile deviation during driving and subsequent removal of casings before concrete setting. These processes can lead to gap formation between piles despite sealing efforts. Over time, concrete surface degradation may worsen this issue, potentially allowing water to penetrate beneath the wharf's slab, leading to the washout of existing materials and the development of scour-induced cavities. we introduce a novel method to effectively address gap formation in continuous concrete pile wharves. Our approach has been successfully implemented in Bandar Anzali, showcasing practical solutions for ensuring the long-term performance of wharf structures.

The US underestimates extreme precipitation with a coarse rain gauge network

Nischal Kafle (*Department of Civil Engineering)*

In this study we investigate the bias introduced in extreme rainfall estimates in the US attributed to the coarse temporal (15-minute) and spatial resolution of the rain gauge network used. We employed a denser German rain gauge network with higher temporal (1-minute) and spatial resolution (on average 15 times that of the US) over a 13-year period to create various low-density realization scenarios. The findings offer insights into optimizing rain gauge networks and comprehending evolving climate patterns in the US. Additionally, the study provides valuable information for updating existing NOAA Atlas 14 rainfall estimates.

Investigating the Immunomodulatory Effects of Manuka Honey and its Components to Prevent Neutrophil-Mediated Fibrosis

Evan Main (*Biomedical Engineering)*

Neutrophils use reactive oxygen species (ROS) activity and a specialized form of cell death named NETosis to kill and ensnare invading pathogens. While these neutrophil behaviors are critical in preventing infection, a dysregulated response can be deleterious and lead to tissue damage and fibrosis at host-biomaterial interfaces. Manuka honey has demonstrated potent antibacterial properties and recently, anti-inflammatory potential. It was hypothesized that applying potentially therapeutic compounds found in abundance within Manuka honey to pro-inflammatory neutrophils will reduce intracellular ROS activity and prevent NETosis. Additionally, it was investigated whether these compounds act more effectively as isolates or synergistically within whole Manuka honey.

Power-Hardware-In-The-Loop System For Investigating Lithium-Ion Battery Degradation Under Realistic Loads

Efat Mohammadi (*Mechanical Engineering)*

Various degradation mechanisms impact batteries performance and longevity. Batteries stability over time, particularly when powered by naturally intermittent renewable sources with fluctuating input power profiles, is a complex issue. Typically, battery degradation tests are not performed under realistic loading scenarios. In this study, a Power-Hardware-in-the-Loop (PHIL) system is introduced to perform aging studies on Li-ion batteries under realistic load profiles. We present requirements for real time testing to achieve an understanding of battery degradation phenomena in real-world applications. We developed a test station that can emulate real loading profiles and monitor system health in response.

Analysis of a Chitosan Wound Care Device for Use in Negative Pressure Wound Therapy

Haley Pruitt (*Biomedical Engineering)*

Negative pressure wound therapy (NWPT) is used to manage wounds by applying sub-atmospheric pressure to the system which provides positive pressure to the surface of the wound. In this experiment, the NWPT system consisted of a flesh analog, foam, fluid collection system, suction pump, and a chitosan wound care device. The goal of the experiment was to test compatibility of the wound care device by seeing if pressure or fluid collection was disrupted. To test compatibility, negative pressure was applied either continuously or intermittently for 72 hours, with the pressure and fluid collection being recorded every 12 hours.

Adaptive-Neuro Fuzzy Inference System (ANFIS) Based Control for Solving Misalignment in Vehicle-to-Vehicle Dynamic Wireless Charging

MD Sadiqur Rahman (*Electrical and Computer Engineering)*

Dynamic wireless charging between vehicles (DWC-V2V) is a burgeoning technology where a dedicated charging vehicle supplies power to a user vehicle. While V2V wireless power transfer has been validated empirically, development of controllers compensating for misalignment issue that causes reduction of power transfer is lacking. To fill in this gap, this research proposes an Adaptive Neuro Fuzzy Inference System (ANFIS) controller based on the reliable 5G communication for DWC-V2V, ensuring constant power regardless of various degrees of misalignment. The performance of the proposed ANFIS controller has been compared with that a fuzzy logic-based controller for the DWC-V2V.

5G-Enabled Battery Energy Storage Management for Grid-Connected Solar Photovoltaic System

Syeda Saiara (*EECE)*

The power generated from the solar photovoltaic (PV) system varies greatly with irradiation levels. Therefore, a battery energy storage system (BESS) along with a sophisticated controller is needed to successfully coordinate the generation and load demand. Although many control techniques for the BESS have been reported in literature, still a novel nonlinear controller that can well minimize power fluctuations under varying irradiance conditions is lacking. Based on this background, this research proposes an advanced controller for the BESS that employs 5G communication. The performance of the proposed controller has been compared with that of a conventional controller for BESS.

Harmonic Chirp Pulse Compression for Super Resolution Ultrasound Localization Microscopy

Helena Sanders (*Biomedical Engineering)*

Microbubble (MB) contrast for ultrasound imaging can safely travel through vasculature and capillaries within the body. MBs produce strong echo signals when excited by ultrasound—echoes that are distinguishable from surrounding tissue and allow enhanced blood flow imaging. This project investigates the simulation of swept frequency “chirp” signals to excite MBs and generate a superharmonic chirp response. The goal is to improve the signal resolution and power for enhanced imaging of dynamic processes such as blood flow. The study examines the chirp signal and its ability to reach pitch speed while maintaining a consistent duration for different frequencies.

Fabricating Synthetic, Small-diameter Vascular Grafts for Bypass Grafting Surgery via Touch-spinning

Jada Sandridge (*Biomedical Engineering)*

Cardiovascular diseases are common conditions that affect the heart or blood vessels. Due to its prevalence, it is important to develop a vascular graft that can be used to bypass diseased, blocked blood vessels. Therefore, the aim of this study is to touch-spin small diameter vascular scaffolds that can potentially be used as an alternative to autologous vessels in bypass surgery. Polydioxanone was touch-spun at 25° and 40° to mimic the extracellular matrix of native blood vessels. The scaffolds underwent microscopy to examine and validate fiber alignment. Mechanical characterization was performed to determine its potential use in surgical procedures.

Implementation of a New Cyber-Attack Detection Method for Electric Vehicle Wireless Charging System

Amani Shehada (*Herff College of Engineering)*

The detection of cyber-attacks in wireless charging systems for electric vehicles (EVs) is important due to the increasing popularity of EVs. Protecting these infrastructure facilities from possible cyber threats affecting their reliability and safety is necessary. This work proposes to develop a new detection technique for cyber-attacks that will ensure the safe and secure deployment of wireless charging technology in the EV sector, resulting in a safer EV charging process for all the stakeholders concerned. The performance of the proposed detection method will be compared with that of a conventional detection method for wireless EV charging.

Novel ConvXGBoost method for Detection and Identification of Cyberattacks on a 5G-enabled Solar Photovoltaic system

Sai Vodapally (*EECE, Herff College of Engineering)*

Integration of solar PV system to the AC grid affects the stability of the connected system due to the low-inertia nature of the inverters. Smart grid-forming inverters that can handle faults and maintain system stability by continuously monitoring the system through SCADA are needed. 5G communication will help to support these developing smart grids due to its ability to handle multiple devices at a faster transfer rate. However, any communications are prone to cyberattacks, and we proposed a novel Convolution extreme gradient boosting (ConvXGBoost) method that can detect and identify the component of the system that was compromised to effectively mitigate the cyber-intrusions.

Evaluation of Mechanical and Degradation Behaviors of Electrospun Chitosan Copolymer Membranes

Ethan Wales (*Biomedical Engineering)*

Electrospun, chitosan membranes (ESCM) have seen success for guided bone regeneration applications. Chitosan is a naturally occurring polysaccharide utilized for many of its pro-healing properties. Previous work has utilized this polymer with other copolymers to increase mechanical and cell-viability characteristics. Further progress has evaluated the usage of crosslinkers to inhibit the loss of nanofiber structure in the electrospun matrix. The usage of these natural membrane matrices often involves host-mediated degradation and mechanical deformation when the materials are physically implanted. This study evaluates the mechanical and degradation properties of different copolymer blends of crosslinked electrospun chitosan membranes.

Composite Photopolymerizable Bio-ink with Magnetic Collagen Fibers Characterization for Guided Muscle Regeneration

Andrew Watson (*Biomedical Engineering)*

To address Volumetric Muscle Loss (VML), we developed a chitosan methacrylate (N-MAC)-polyethylene glycol dimethacrylate (PEGDMA) hydrogel, reinforced with aligned electrospun magnetic collagen (MC) fibers, forming a composite bioink (NPC) for 3D printing. The goal of this work was to evaluate the NPC bio-ink printing characteristics and its ability to induce cell group alignment. The N-MAC-PEGDMA ink provides stable 3D printing, demonstrates self-supporting behavior, and improved scaffold strength. Integrating MC fibers into bioink significantly improved cell alignment compared to the bioink alone. Our findings highlight NPC's advantageous printing behavior and cell alignment capabilities, making it a promising option for VML recovery.

LIBERAL AND FINE ARTS

Research Trends in the International Journal of Music Education : A Topic Modeling Approach

Janel Long (*Rudi E. Scheidt School of Music, Music Education)*

In this study, I investigate shifts in research trends over the period of 2013-2023 in the International Journal of Music Education using a topic modeling approach. This study aims to examine whether topic modeling tools yield meaningful implicit trends not readily captured by keyword frequencies alone and capture shifts in these implicit trends over time. The secondary goal of the study is to examine the potential influence highly cited authors and institutions may have on dominant topics identified. Identifying implicit trends can bring more awareness of the potential influence dominant trends may have and help identify potential gaps in research.

Visualization of Hyper-specific Feminist Community: Institutional Critique, Abstraction, and Intergenerational Exchange

Sophia Mason (*Fine Art)*

Welcome to the Ida Emmeline Wells Visualization of Feminism. This body of work examines a hyper-specific, mormon feminist community by visualizing aspects of its data as an ecosystem. The artifacts, species, and models you'll see in the exhibition are fabricated, but bring form to individuals' efforts, impacts, struggles, and legacies and how generations of activists impact and renew knowledge of each other. A lecture discuss ways individuals can prepare for environmental change in their own ecosystems. Please find a park ranger if you have any questions.

LIFE AND HEALTH SCIENCES

Association of Environmental Factors with Breast Cancer Incidence among African American Women in Memphis, Tennessee

Namuun Batbaatar (*School of Public Health)*

African American women confront distinct challenges and disparities in breast cancer rates compared to other racial and ethnic groups. This study aims to examine the association between breast cancer incidence and environmental factors among a high-risk female population in Memphis, Tennessee. The STAR study recruited 355 African American women ages 20 – 88 in Memphis from 2015-2016. The subjects had geocodable addresses, and their census-tract-level environmental and socioeconomic data were obtained from EJScreen and EnviroAtlas databases. The final dataset contained 50 cases and 157 controls. Spatial clusters of cases were examined using the clustering tool in ArcGIS. The associations between breast cancer incidence and ten social and environmental factors were examined using logistic regression. Traffic proximity was the only significant environmental factor that elevated the odds (Odds ratio = 2.032, 95% confidence interval = 1.182, 3.496).

The Effects of Mitochondrial Transplant Therapy on Muscle Damage and Exercise Performance

Samantha Davis (*College of Health Sciences)*

To determine if weekly mitochondrial transplants can improve muscle damage and running performance. Weekly mitochondrial transplants were given to C57/BL6 male mice (N=7/group) for 6 weeks during a muscle damaging exercise protocol. A run-to-fatigue test was performed. No significant differences were detected in exercise performance or muscle fibers of the tibialis anterior (TA) between groups. TA transcript levels of PGC1-α did not differ but was reduced in liver ($p = 0.01$) with the mitochondrial transplant. IL-6 was significantly reduced immediately after exercise in the transplanted group ($p = 0.03$). Mitochondrial transplant did not improve performance but altered exercise-induced IL-6.

Leveraging Epigenomics Data for Pathway-Based Molecular Biomarkers in PTSD Subtype Identification

Maziar Ganji (*Department of Biological Sciences)*

Bioinformatics studies suggest PTSD-associated changes in molecular modules. We applied pathway-based analytical tools to epigenomics data, and nearly one million DNA methylation from >1000 U.S. Army veteran and active-duty volunteers were gathered to classify PTSD subtypes based on severity, cognitive impairment, and depression. We used knowledge-driven and data-driven Random Forest(RF) classification with Pathway-Activities(PAs) and the Core-Module-Inference(CMI) algorithm. We identified subtype-specific pathways and features from apoptosis, oxidative stress, and inflammation pathways and achieved an AUC of ~0.80 classifying severe versus mild/moderate PTSD cases. These identified processes and biomarkers provide a deeper understanding of the molecular underpinnings of PTSD subtypes.

SARS-CoV-2 envelope protein effect on immunometabolism when stimulated with chetomin and 2-DG

Brenda Landvoigt Schmitt (*College of Health Sciences)*

SARS-CoV-2 represents a great concern for public health. The envelope protein (Epro) is involved in pathogenesis and causes overexpression of inflammatory cytokines. We inhibited metabolic reprogramming in monocytes and observed inflammatory and metabolic responses to Epro. For inhibitor assays, monocytes were seeded on Seahorse plates and treated with chetomin or 2-DG. Following treatment, monocytes were stimulated with Epro or media and evaluated for glycolytic reprogramming on a Seahorse XFp. qPCR was used to measure inflammatory cytokine gene expression. We observed that 2-DG but not chetomin suppressed the glycolytic and inflammatory responses to Epro.

Mapping Major Pollution Sources in Tennessee: Identifying Key Environmental Challenges:

Blake Moseley (*Public Health)*

The press reports environmental pollution events of the most public concern and thus may help reveal environmental justice (EJ). This study aims to identify environmental equity using press reports. A total of 1,800 news articles were collected from Google News for any environmental pollution events in Tennessee during 2019-2023 using the API technology. The top 400 relevant articles were manually examined for their location and time. In Tennessee, most disadvantaged counties have no or only one newspaper, becoming “news deserts.” Most reported pollution events occurred in disadvantaged counties, revealing widespread environmental inequity in Tennessee.

Metformin effect on monocyte inflammatory response to SARS-CoV-2 spike protein

Rafael Moura Maurmann (*Health Sciences)*

Severe SARS-CoV-2 is majorly characterized by monocyte and macrophage hyperinflammation. Metformin is a potent suppressor of monocyte immune activation, thus we aim to investigate its effect on monocytes stimulated with SARS-CoV-2 spike protein. We isolated monocytes from healthy 18-40-years-old subjects and treated with metformin, rotenone (complex I inhibitor), S1QEL (complex I superoxide-specific scavenger), or A769662 (AMPK activator) for 1h prior to glycolytic and oxidative metabolic activation assays with spike protein. Inflammatory protein gene expression was assessed subsequently. Metformin pre-treatment reduced glycolytic activation and mitochondria respiration while partially suppressing inflammation. No other treatment replicated metformin metabolic effect or reduced inflammation.

Effect of Sex on the Development of NAFLD During the Progression of Metabolic Syndrome

Noah Wallace (*College of Health Sciences)*

There is an association between sex and the prevalence of MetS and NAFLD. 30 male and 30 female C57BL/6 mice were place on one of three diets: High Fat, High Sugar, and Control. Male mice on a High Fat diet showed the greatest weight gain as well as demonstrated earlier signs of insulin resistance. A high sugar diet had indications of liver fibrosis. Sex affected expression of SREBP-1c and ChREBP but not associated lipogenic genes. There are diet and sex differences in the signaling for liver DNL that may contribute to the dimorphic development of NAFLD and MetS.

MATH AND COMPUTER SCIENCES

A longitudinal study on kidney hyperfiltration in patients with Sickle Cell Disease

Shuyan Chen (*Biostatistics)*

This study utilized diverse biostatistics techniques to investigate estimated glomerular filtration rate (eGFR) in 350 Sickle Cell Disease (SCD) participants. Proportion analysis and McNemar's exact test revealed higher hyperfiltration prevalence in HbSS/HbSβθ groups and children. Linear mixed model demonstrated eGFR's time course change. COX proportional hazards and logistic regression models indicated hyperfiltration's association with increased persistent albuminuria risk and elevated hemolysis markers. Notably, hydroxyurea (HU) treatment and chronic blood transfusions (CTXN) significantly accelerated hyperfiltration normalization. These findings underscore early hyperfiltration detection and targeted interventions to mitigate kidney disease progression in SCD patients.

Greedy search for a heterogenous weighted Ensemble Hyperspectral Anomaly Detector

Mazharul Hossain (*Computer Science)*

Advancements in hyperspectral sensing have allowed recording over several hundred spectral bands in a single acquisition and detailed examination of different materials in the scene. Hyperspectral anomaly detection (HS-AD) helps characterize scenes and separates anomaly and background class. It is vital in agriculture, environment, and military applications such as RSTA missions. To improve detection accuracy, we have designed an equal voting ensemble of hyperspectral unmixing and three heterogenous HS-AD algorithms' results. Unmixing can guide our solution to a specific problem using a target spectral signature. In this work, we present a greedy search to automatically determine the best HS-AD methods for the voting ensemble and utilize a supervised classifier to determine the weights assigned to each method in the voting. Our evaluation shows that this new technique achieved a 9% higher average F1-macro score than our previous equal voting ensemble method and at least 10% higher than the individual methods used in the ensemble.

Momentary Stressor Logging and Reflective Visualizations: Implications for Stress Management with Wearables

Sameer Neupane (*Department of Computer Science)*

Commercial wearables from Fitbit, Garmin, and Whoop have recently introduced real-time notifications based on detecting changes in physiological responses indicating potential stress. In this paper, we investigate how these new capabilities can be leveraged to improve stress management. We developed a smartwatch app, a smartphone app, and a cloud service, and conducted a 100-day field study with 122 participants who received prompts triggered by physiological responses several times a day. They were asked whether they were stressed, and if so, to log the most likely stressor. Each week, participants received new visualizations of their data to self-reflect on patterns and trends. Participants reported better awareness of their stressors, and self-initiating fourteen kinds of behavioral changes to reduce stress in their daily lives. Repeated self-reports over 14 weeks showed reductions in both stress intensity (in 26,521 momentary ratings) and stress frequency (in 1,057 weekly surveys).

Towards Improving Code Comprehension skills among CS1 and CS2 students

Priti Oli (*Computer Science)*

The significance of code comprehension skills, crucial for both professionals and beginners, is often overlooked in computer science education. Code comprehension involves building the mental representation of the code. Although both students and professionals spend substantial time reading code, there needs to be more emphasis on fostering comprehension skills. Code tracing and reading are considered vital in early programming learning stages. We present our work on enhancing code comprehension for CS1 and CS2 students, investigating resources, tools, and techniques to aid novice programmers in developing a profound understanding of programming concepts and techniques.

E2MA: Using Wearable AI to Improve the Prompt Efficiency of EMA in Capturing Stressful Experiences

Mithun Saha (*Computer Science)*

The performance of Artificial intelligence (AI) algorithms for detecting stress via smartwatches has yet to reach the desired accuracy in field studies. Therefore, just-in-time (JIT) stress interventions still rely on Ecological Momentary Assessments (EMAs). We propose Event-triggered EMA (E2MA) to show how imperfect AI algorithms can be used to improve the prompt efficiency of EMA, i.e., the chance of catching participants in stressful moments. To evaluate the proposed E2MA design choices, we use the data collected in a 100-day study with 118 participants where EMA's delivery was guided by the detection of stressful moments by a new smartwatch app. Results show that using even imperfect AI algorithms can increase the prompt efficiency of EMA by 70% over random prompts. These results suggest that using the capability of smartwatches can reduce participant burden in studies using EMA's for JIT intervention.

Pollard's Theorem and Its Structural Generalizations in General Abelian Groups

Runze Wang (*Department of Mathematical Sciences)*

Pollard's theorem gives a bound on t-representable sums in cyclic groups of prime order. In this presentation, we show a Kneser-type theorem in the form "if we don't have the bound, then we will get some strong structural information", which generalizes Pollard's theorem to general abelian groups. This result optimizes a theorem given by Grynkiewicz by improving the coefficient of the quadratic term, and still preserves all the structural results in that theorem.

Towards Fair, Robust and Efficient Client Assessment in Federated Learning

Meiying Zhang (*Computer Science)*

Federated Learning (FL) enables collaborative training of machine learning models among multiple data holders (clients) without sharing their local data. Assessing the contributions of individual clients to FL is crucial for client selection and compensation. The challenge lies in non-independently and identically distributed data and the risk of attacks from malicious clients. In this study, we propose a novel method for quantifying client contributions in FL. The method estimates the ground truth model from clients' local model updates in an attack-resilient manner, and efficiently computes contributions solely from model parameters without validation datasets required in most existing methods.

PHYSICAL AND APPLIED SCIENCES

Rupture Scenarios of the San Andreas Fault Informed by Displacement History on Normal Faults

Luis Bazan Flores (*CERI)*

We investigate the dynamic interactions between the southern San Andreas Fault (SSAF) and a proximal normal fault (NF) beneath the Salton Sea in southern California. The NF exhibits 11 to 15 displacement events. At least three events may align temporally with SSAF earthquakes, raising questions about the possible interplay between the two faults. Utilizing dynamic rupture models, we analyze the coseismic interactions between the SSAF and NF, addressing under what conditions the SSAF induces slip on the NF. Our research contributes towards discussions regarding the seismic hazard in southern California shedding light on the complex interplay between the faults.

Lipid Membrane Interactions with Polymer Grafted Nanoparticles using a Coarse Grain Model

Jordan Darling (*Applied Physics & Materials Science)*

Studies have been performed to investigate interactions between nanoparticles with lipid membranes. The fluidity and elasticity of a lipid membrane allow it to deform, such as it conforms to the surface of an adhering nanoparticle to an extent determined by the adhesive interaction and the membrane's curvature energy. These deformations can be long-ranged and, thereby, lead to membrane-curvature-mediated interaction between adhering nanoparticles, which may cause nanoparticle aggregation. High adhesive interaction leads to endocytosis of nanoparticles. Partially grafting nanoparticle surfaces with hydrophilic polymers prevents both endocytosis and aggregation. Simulations are performed to determine the optimal parameters to suppress endocytosis and aggregation.

Separation of Intrinsic and Scattering Seismic Wave Attenuation in the Crust of Alaska

Anuradha Mahanama (*The Center for Earthquake Research and Information (CERI))*

Thorough seismic hazard analysis is vital for assessing earthquake impact on structures and lives, especially in quake-prone regions like Alaska. Accurate evaluation relies on dependable ground motion prediction equations. Yet, in areas with diverse crustal attenuation like Alaska, equation reliability may falter. Alaska's elevated Lg Q compared to western U.S. and Canada notably affects ground shaking duration and intensity, crucial in hazard assessment. Neglecting these regional nuances risks inaccurate assessments. To delve deeper, this study proposes Coda Q analysis to probe scattering and intrinsic crustal attenuation in central and south-central Alaska. Focusing on earthquakes of 2 to 6.5 magnitude from December 2014 to December 2020, within 20-110km epicentral distance and <30km focal depths, the research aims to differentiate intrinsic and scattering attenuation using the MLTWA method with center frequencies of 0.75 to 12.0 Hz across three time windows (0-15 s, 15-30 s, and 30-45 s from S arrival). By examining regionalized attenuation values and their frequency dependencies, the study seeks to elucidate crustal attenuation variations in central and south-central Alaska, potentially refining ground-motion prediction equations for better seismic hazard assessments.

Application of Singular Spectrum Analysis to Decompose GPS Time Series

Khadija Nadimi (*CERI)*

High-Rate GPS recordings from the epicentral region of the 2013 South Scotia Ridge, MW7.8, earthquake exhibit large oscillations and overshoots during the development of the coseismic static offset. This has raised the question of the fault dynamically overshooting and then returning to the final static displacement. Simple polarization analysis shows that the oscillations can be rotated into a radial and transverse set of axes suggesting retrograde cyclic motion and transverse motion. A second coordinate axis, rotated with respect to the first, can also be defined as containing the coseismic offset. The particle motions in both systems, however, still contain overlapping cyclic and coseismic offset components. To test the hypothesis that the overshoots are due to surface waves, we applied Singular Spectrum Analysis (SSA). SSA is a non-parametric signal modeling method that produces a set of basis functions, known as orthonormal empirical eigenfunctions, that can be used to decompose a signal into a trend, oscillatory signals, and noise. SSA produces three identifiable signals: a trend without overshoots representing the time history of the coseismic offset and two separate signals best explained as Rayleigh and Love waves match in time with the overshoots in the raw seismograms. Our results with 1 Hz HRGPS time series for the 2013 South Scotia Ridge earthquake clearly show that SSA can, in this case, separate the signals. The next step is to use multichannel SSA to simultaneously perform the polarization analysis, in addition to the signal separation. Furthermore, we will also examine HRGPS data from 2010, MW8.8, Maule, 2015, MW8.3 Illapel at 1 Hz, 2012, MW7.6, Nicoya Earthquake in Costa Rica at 5 Hz, and 2009, MW6.3, L'Aquila earthquake in Italy at 10 Hz. Another application of SSA analysis includes the decomposition of traditional GPS daily-position time series to obtain better estimations of the observed cyclic motions than those provided by the traditional parametric method. Decomposing the ground displacement time series into identifiable and modellable components will contribute to understanding shaking in the epicentral area. This information can then be applied to seismic hazard analysis of the region. In addition, obtaining better estimates of the cyclic signals can significantly improve the modeling of vertical signals and crustal elastic parameters. Keywords: GPS, Coseismic, SSA, Seismic Hazard Analysis

SOCIAL AND BEHAVIORAL SCIENCES

Nourishing Health: A Comprehensive Approach To Tackling Food Insecurity And Outcome Of Healthcare Intervention

Pratiksha Bhagwat (*Public Health)*

The Food Pharmacy Project investigates significant social determinant of health (SDOH) – food insecurity, this challenge is being addressed by healthcare providers. This project proficiently addresses nutritional needs through a systematic screening process, ensuring that identified food-insecure patients receive ongoing nutrition support. In collaboration with the Memphis Food Bank, the Methodist hospital is delivering nutritional support and sustainable assistance, exemplifying the evolving role of healthcare providers in addressing SDOH. This study is based on the analysis of patient's screening data, highlighting the correlation between food insecurity, patient demographics and health outcomes. Further research will assess the long-term impact on health outcomes.

"Strengthening U.S. Communities: Leveraging Social Capital for Enhanced Economic Integration and Inclusivity"

Babatunde Dallas (*MIS)*

This research investigates the enhancement of economic connectedness in U.S. communities through the lens of social capital, leveraging datasets from Meta and various grant sources. By analyzing the interplay of social ties across counties, ZIP codes, high schools, and colleges, we aim to advance state-level integration and enrich social capital. Our study methodically examines social interactions among diverse demographics and educational settings to reveal patterns conducive to community resilience and economic growth. The findings offer actionable insights and propose interventions to cultivate inclusive economic landscapes, with an emphasis on cross-socioeconomic status (SES) engagement and the integration of technological innovations for broader inclusion.

Social Reward and Mesolimbic Dopamine Release in C57 Male and Female Mice

Travis Erickson (*Psychology)*

Current study will examine the relationship between aspects of NAc dopamine release stimulated with both phasic and tonic stimulation patterns and social reward preference in C57Bl/6J mice. Social conditioned place preference will be used to assess preference/aversion to chambers associated with social interaction. Following sCPP, we will use in vivo fixed potential amperometry to measure VTA stimulation-evoked (both phasic and tonic patterns) dopamine release in the NAc of anesthetized mice. Results would inform understanding of how drug reward salience differs across the spectrum of social preference.

Examining The Prevalence Of Dental Caries In A Memphis Pediatric Dental Practice

Cynthia Freeman (*Public Health)*

Dental cavities are a pressing issue among children in the US. This study examined over 5,000 patients aged 2-18 who received cavity treatments from 2019-2023. Results show a slight increase in cavities, notably from 2022-2023, with females receiving more treatments, particularly fillings and extractions. Six-to twelve-year-olds had the highest treatment rates. African Americans demonstrated a higher risk due to oral health practices. Targeting age and gender-specific interventions and improving parental health literacy, especially among African Americans, are crucial for cavity prevention. These findings inform tailored strategies and address oral health knowledge gaps, enhancing preventive measures.

Association between non-suicidal self-injury and mental health among adolescents in the US.

Pamela Graham (*Social and Behavioral Sciences)*

Adolescents of high school age (14 – 18+ years) have been found to be prone to risky behaviors. However, they are still cognitively developing and are emotionally vulnerable, especially in relation to the impact of their actions on their biological, psychological, and social well-being. The United States justice system penalizes adolescents of color in harsher ways and at a higher rate than their white counterparts for behavioral misconduct and substance use, both of which are categorized as non-suicidal self-injury (NSSI) in literature. Our primary hypothesis is that delinquent and substance-related behaviors are associated with lower mental health outcomes and lower social reinforcement, and secondarily that variance in association are related to race and ethnicity. Survey responses to the 2021 Youth Risk Behavior Surveillance System (n = 17,232) was utilized for this study. Our regression analysis indicates that there is an inverse association between delinquent and substance-related behaviors and mental health outcomes and social reinforcement factors; minority youths are disproportionately affected. Increasing understanding of the role of NSSI in adolescent behavior will contribute to reducing race-related disparity in adolescent and juvenile convictions. Moreover, this study will help with developing preventative strategies to provide buffering resources for the communities adversely impacted by excessive NSSI and juvenile convictions.

Unraveling the Housing Affordability Struggles Among International Students at the University of Memphis (UofM)

Rifat Jahan Loran (*Urban Affairs)*

This study explores the housing struggles experienced by international students at the University of Memphis (UofM), amidst a growing trend of international enrollment in higher education. It focuses on precarity, examining accessibility, affordability, and discrimination, especially how being international worsens these issues. Through content analysis, I aim to understand international students' unique experiences and see if these challenges have caused housing segregation. Additionally, I'll explore the strategies international students use to support each other in finding housing. The study ends with recommendations for universities to create more inclusive housing systems.

Clean Water, Hygiene, and Access to Healthcare Challenges in Peru

Jamecia Richardson (*School of Public Health)*

In low-income countries, water-borne diseases directly correlate to inadequate access to safe drinking water and water education. Addressing these challenges in rural areas of Peru, specifically in Pucallpa, is critical. This study implements a two-pronged approach to assess population health needs and propose sustainable public health interventions. Applying interviews with tribal leaders and observing the built environment, the study aims to obtain information regarding water, sanitation, and hygiene problems. Researchers utilized qualitative methodology through a 16-question survey administered to six community leaders in Peru. The findings revealed inequalities in access to clean water, sanitation services, and healthcare.

Mental Health Disorders and Risky Behavior for HIV Among Sex Workers

Frans Samosir (*Social and Behavioral Sciences)*

Sex workers are vulnerable to experiencing violence, which impacts their mental health. This study aims to understand the dynamics of mental disorders and HIV risk behaviors among sex workers. Sixteen articles meeting the inclusion criteria published between 2015 and 2020 were examined. Physical/sexual violence, societal or familial stigma, low economic status, childhood trauma such as family dysfunction and sexual abuse, inconsistent condom use, alternating needle drug use, and low HIV-related knowledge have been shown to be associated with mental disorders and HIV risk behaviors among sex workers. Common mental disorders experienced by sex workers include depression and anxiety disorders.

(It's going to change) uncovering and quantifying Memphis one layer at a time

Christine Smith (*Earth Science)*

Creating and working a dig in a small neighborhood yard in Memphis, TN for an archaeological project for the master's program at the University of Memphis. A 3 by 3-meter square is used to gain experience in archaeological techniques of digging, sifting, and collecting all matter that remains. Sorting to recover possible historical artifacts to be analyzed and catalogued, also retaining the rocks, botanical items, and samples of soil, to further sort, identify, and create a data set for each category to give further insight to the layers of excavation two inches at a time.

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