University of Massachusetts Dartmouth
Sigma Xi Scientific Research Honor Society
28th Annual Research Exhibition

April 17-18, 2024
Library Living Room

Schedule of Events

Wednesday, April 17

10:00 – 1:00	Registration and poster setup
1:00	Opening remarks by Provost Ramprasad Balasubramanian
1:00 – 3:00	Poster session and judging

Thursday, April 18

10:00 – 12:00	Poster session and judging
12:30	Presentation of prizes

Lunch will be served for presenters at noon on both days.

2024 Exhibition Organizing Committee

Tara Rajaniemi, Sigma Xi Chapter President (Biology)
Genevieve Kozak (Biology)
Diana Barrett (Biology)
Brittany Velikaneye (Biology)
Elizabeth Winiarz (Retired Science Librarian)

Acknowledgements

Poster Abstracts

Posters are listed alphabetically by presenter's academic department and last name.
(U) = undergraduate student, (G) = graduate student, (P) = postdoctoral fellow, (F) = faculty

1. Artemisia Gentileschi: Hidden Contributions

Caitlyn Haley (U), Art Education, Art History & Media Studies
Matthew Sneider (F), History

Artemisia Gentileschi was a 17th century Baroque artist from Italy. Despite achieving success in her lifetime, a traumatic event overshadows her art career. At age nineteen, Artemisia was raped. My research question was "How did this traumatic event influence Artemisia Gentileschi's art?"
My research method involved comparing two specific paintings, both called Judith Slaying Holofernes. In both versions, the Biblical heroine Judith is beheading her enemy with a sword. Both feature the climactic scene from the Book of Judith. The first was completed in 1612-13. The second was completed around 1620. Both feature the climactic scene from the Book of Judith. However, there are differences. I compared color, shape, composition, and light to uncover the connection between Artemisia's trauma and her choice of subject matter. Artemisia painted a woman physically overpowering a man. She chose a famous woman from the Bible to prove that she would not be defined by her trauma.
In conclusion, I believe Judith is a self-portrait of Artemisia overcoming her trauma. Stylistic changes between the paintings reflect the healing process as Artemisia grew older and processed what happened to her.

2. Examining mitochondrial and nuclear genetic differentiation of elfin butterflies

Holly Silvestre (U), Biology
Uma Knaven (G), Biology
Genevieve Kozak (F), Biology

North American *Callophrys* elfin butterflies overlap in range in pine barren habitats. Little is understood about their divergence or levels of gene flow. We investigated genetic differentiation between species using brown elfin (*Callophrys augustinus*) and eastern pine elfin (*C. niphon*) samples collected from Massachusetts in Spring of 2023. Three nuclear genes, elongation factor 1 alpha (EF1a), isocitrate dehydrogenase (IDH), and acetoacetyl-CoA thiolase (AACT), and one mitochondrial gene, cytochrome c oxidase subunit I (COI), were amplified with custom primers and PCR. The genes were sequenced with Sanger sequencing and used to construct gene trees and haplotype networks with additional publicly available data from other elfin species. The gene trees were discordant, suggesting gene flow occurred during elfin species divergence. Additionally, the haplotype networks showed some *C. augustinus* are more related to other elfin species than each other, suggesting gene flow has occurred.

3. Epigenomic response of *Ostrinia* moths to elevated pupal and adult temperature

Brittany Velikaneye (G), Biology
Genevieve Kozak (F), Biology

Heat during the pupal and adult stage reduces reproductive output in European corn borer moths (*Ostrinia nubilalis*), but the mechanisms underlying this response are unknown. Here, we examine how heat during those life stages affects DNA methylation patterns using whole-genome enzymatic Methyl-Seq. We compared patterns of methylation in males and females that experienced 23°C throughout life or experienced heat (28°C) to determine if there were consistently differentially methylated regions (DMRs) among treatments. There were major changes in methylation in both sexes after heat exposure, with 95% of DMRs being significantly different in only one sex and there were significant methylation differences between heat-exposed males and females, suggesting that changes in methylation to heat may be sex-specific. The genetic pathways that showed heat-induced methylation changes included Hippo signaling and ubiquitin mediated proteolysis. Genes involved in DNA repair and gametogenesis also exhibited differences. Our results provide insight into epigenetic responses to climate change and suggest novel pathways involved with temperature stress during reproduction.

4. Tuning Reduction Potentials of Vanadium-based Electrolyte for Redox Flow Batteries: A Quantum Chemical Study

Yusif Ahmed Abdulai (G), Chemistry & Biochemistry
Visayas Benjoe
Miller Adrian
Maricris Mayes (F), Chemistry & Biochemistry

The depletion of fossil fuels has increased the need to maximize the use of renewable energy sources. Non-aqueous redox flow batteries (NRFBs) are an emerging technology that offers scalability suitable for grid installations. However, the reduction potentials of current lead-candidate redox-active materials for NRFBs still need to be tuned to maximize the electrochemical stability window, which in turn optimizes the battery's output voltage. Here, we report quantum mechanical calculations aimed at tuning the reduction potentials of a leading active material, vanadiumIV bis-hydroxyiminodiacetate (VBH), for enhanced NRFB performance. In this study, we explored the effect on the reduction potential of modifying VBH structure with electron-withdrawing groups (EWGs) and electron-donating groups (EDGs) as well as using acetonitrile (MeCN) and dimethyl sulfoxide (DMSO) solvents. Our findings show that EWGs such as fluorine increase the reduction potential, while EDGs such as methyl lower the reduction potential. The findings depicted higher reduction potential in MeCN than in DMSO. This method offers a way to tune the reduction potentials for designing electrolytes for energy storage.

5. Inhibition Effects of Blueberries on α-Glucosidase

Joshua Bernadin (U), Chemistry & Biochemistry
Shuowei Cai (F), Chemistry & Biochemistry

Type-2 diabetes makes up a vast majority of diabetes cases worldwide. One treatment for type-2 diabetes are alpha-glucosidase inhibitors. These prevent alpha glucosidase from breaking down complex carbohydrates into simple sugars, which prevents spikes in blood sugar levels. Blueberries are rich in antioxidants and have shown neuronal protective properties. Here we investigate the effects of blueberries on α-glucosidase. This was done by spectrophotometrically measuring the inhibition of α-glucosidase using a blueberry extract. Our preliminary results showed that blueberries can inhibit α-glucosidase at sub mg/mL concentration. This indicates that blueberries consumption may be able to treat diabetes.

6. Ultrasound-Assisted Extraction, Bioassay-Guided Fractionation, and in vitro Anti-Inflammatory Screening of Terpenoid-Rich *Vaccinium macrocarpon* (American Cranberry) Pomace

Md Sagir Mia (G), Chemistry & Biochemistry
Catherine Neto (F), Chemistry & Biochemistry
Hang MA (F), University of Rhode Island College of Pharmacy
Christina Khoo, Ocean Spray Cranberries Inc
Liang Xue

Vaccinium macrocarpon (American Cranberry) is an endemic plant in North America used to produce juice and products. After juice processing, cranberry peels, skins, and seeds are discarded as a waste product known as pomace. An ultrasound-assisted successive extraction method was developed to maximize the isolation of bioactive terpenoids with anti-inflammatory and anti-proliferative properties from cranberry pomace. HPLC and UPLC-MS methods were developed to identify and quantify pentacyclic triterpenoids, phytosterols and tocopherols. An acetone extract containing 70% triterpenoids and sterols was fractionated on silica gel. We performed preliminary screening for the anti-inflammatory activity of this extract and fractions using the THP-1 monocyte model. ELISA was used to measure production of IL-1b, a biomarker of inflammasome activation. Fraction D, rich in sitosterol, tocopherols and unidentified triterpenoids was highly potent (1.25-100 ug/mL) in reducing IL-1b expression; Fraction J, rich in ursolic and oleanolic esters also showed significant inhibition at test concentrations. Cranberry pomace was found to be a rich source of anti-inflammatory natural products.

7. Impact Of Different Extraction Solvents On Phenolic Content And Antioxidant Potential Of Cranberry (*Vaccinium macrocarpon*) Pomace

Maureen Otieno (G), Chemistry & Biochemistry
Elena Depra (U), Chemistry & Biochemistry
Ryley Thatcher (U), Chemistry & Biochemistry
Catherine Neto (F), Chemistry & Biochemistry

Cranberry pomace is a by-product of cranberry processing comprised of seeds, skins, and stems of the cranberry fruit. It contains beneficial polyphenols which are an extensive group of chemicals endowed with antioxidant activity by their numerous phenol groups. Our objective is to maximize the yield of these compounds from pomace. It is well established that various extraction factors, including the method, temperature, time, and solvent system, significantly influence the antioxidant quality of plant-derived products. In this study, we examined the impact of different extraction solvent mixtures including acetone, ethanol, ethyl acetate, and/or methanol, with different percentages of water and formic acid (v/v/v) on antioxidant efficiency and total phenolic content (TPC) of cranberry pomace extracts. DPPH and Folin-Ciocalteu assay were used for antioxidant analysis while DMAC assay was used to quantify proanthocyanidin (PACs) content. Other polyphenolic compounds were identified and quantified using HPLC. Two solvent mixtures yielded the best TPC values, DPPH activity, PACs content, and polyphenol HPLC profile. The antioxidant activity correlated positively with phenolic content.

8. Development of a Homogeneous Time-Resolved Fluorescence Resonance Energy Transfer (TR-FRET) Assay for High-Throughput Screening of Inhibitors Against HIV-1 Nef-Mediated CD4 Downregulation

Fatema Yeasmin (G), Chemistry & Biochemistry
Jia Xiaofei (F), Chemistry & Biochemistry

The HIV-1 protein Nef is a critical factor in viral pathogenesis. As a master of protein-protein interactions (PPIs), Nef interacts with dozens of host proteins, through which multiple cellular pathways are modulated to favor viral replication and spread. Of the many Nef functions, surface downregulation of CD4 is the most prominent and contributes significantly to the pathogenic effect of Nef. Therapeutic inhibition of the viral protein Nef is an intriguing direction of antiretroviral drug discovery as it may revitalize immune mechanisms to target and kill HIV-1-infected cells. Our recent crystal structure has unraveled the molecular details of how Nef mediates the downregulation of surface CD4 through hijacking clathrin AP-2-dependent endocytosis. Guided by the new structural knowledge, we have designed and developed a time-resolved fluorescence resonance energy transfer (TR-FRET) assay for screening for inhibitors that could disrupt Nef's activity in downregulating CD4. After optimization (concentrations of the various components, incubation time, DMSO tolerance, etc.), the assay now has a good signal window and the ability to detect competitive inhibition, making it suitable for high-throughput screening.

9. Low Dissolved Oxygen (DO) Operation of Biological Nutrient Removal (BNR) – Membrane Bio Reactor (MBR) Processes

Gourav Shil (G), Civil & Environmental Engineering
Sukalyan Sengupta (F), Civil & Environmental Engineering

Naval ships contain holding tanks that are used to contain blackwater (BW) and graywater (GW) until the vessel is located outside regulated waters for allowable discharge, or until the BW/GW can be transferred to an in-port facility or barge. With impending changes in regulations, the traditional holding capacity may no longer be adequate, forcing Department of Defense (DoD) to consider onboard treatment technologies for BW/GW. An ideal treatment scheme should be capable of producing an effluent that can meet international discharge standards and meet the following criteria: (1) it should require minimal energy (KWh/million gallons of wastewater treated); (2) it should produce effluent water of a quality that can be reused in the ship, albeit for non-potable applications; (3) it should be robust enough to handle wide variations in hydraulic and organic loading; and (4) it should not require skilled technical personnel for operation and maintenance. . This project explores a low DO Anoxic/Oxic (A/O) Biological Nutrient Removal - Membrane Bioreactor (BNR-MBR) process which meets all the above-listed criteria. It achieves carbonaceous removal as well as nitrogen reduction (through nitrification and subsequent denitrification). Due to the low Dissolved Oxygen (DO) of 0.3 - 0.5 mg/l in the micro-oxic chamber, the process can achieve significant savings in operation (blower rating and frequency of operation).

10. Automated Medical Coding Using GPT-Enhanced Text Mining

Joshua Carberry (G), Computer & Information Science
Haiping Xu (F), Computer & Information Science

In the healthcare domain, ensuring billing accuracy and treatment effectiveness requires that specific and unique medical codes be accurately labeled in a doctor's notes to truly reflect a patient's diagnosis. However, medical coding has long been plagued by its labor-intensive nature, high complexity, inherent ambiguity of natural language, and multifaceted aspects of healthcare. In this poster, we introduce a GPT-enhanced text mining approach designed to automate the labeling of medical codes for doctor's notes. Our approach employs a fine-grained hierarchical strategy to systematically annotate individual diagnoses. Leveraging the advanced capabilities of the language model GPT-4, our method generates concepts that are semantically related to the diagnosis under consideration. Subsequently, the doctor's notes are scrutinized to extract semantically related information and enrich the dataset. The resulting fine-grained data points are categorized through a hierarchical model that ultimately predicts International Classification of Diseases (ICD) codes. Through empirical demonstrations, our approach shows excellent performance on real datasets involving a subset of ICD codes.

11. Rainfall Estimation from Hydrophone Spectra at Different Depths

James Bourgeois (U), Electrical & Computer Engineering
John Buck (F), Electrical & Computer Engineering
Amit Tandon (F), Mechanical Engineering

Berg (2023) successfully estimated rainfall from broadband acoustic spectra recorded by a shallow-water hydrophone at 1 meter depth. This was accomplished by first detecting the rain with a binary Support Vector Machine, followed by a Linear Minimum Mean-Squared Error regression to estimate the rain rates from the acoustic spectra. This project estimates the rainfall with linear regression from the broadband spectra from both a shallow hydrophone at 1 meter depth and a second hydrophone at a depth of 7 meters. This approach compares rainfall estimates from the spectra of each individual hydrophone to determine which hydrophone depth contains more information about the rain rate, and compares these rainfall estimates with a rainfall estimate produced by the combined spectra of both hydrophones to determine whether the hydrophones record different information about the rain. The approach computes a LMMSE regression from 5-minute rainy PSDs to estimated rain accumulation in each 5-minute window, training the regression with rain gauge measurements in 5-minute intervals. [Supported by ONR/MUST program]

12. An environmentally informed active sonar

Kenneth Bowers (G), Electrical & Computer Engineering
Riley Nilson, Electrical & Computer Engineering
Paul Gendron, Electrical & Computer Engineering

We are interested in the development of active sonar detection strategies that leverage awareness of the environment. \A Bayes Factor (BF) inference processor for high frequency broadband active sonar with short vertical arrays operating in shallow water ocean waveguides can exploit relatively depth invariant modes of propagation when apriori knowledge of the depth dependent temperature and salinity is available. Acoustic scattering from a depth uncertain mobile object of interest characterizes the compound alternative hypothesis. Approximations are presented and inferences regarding the presence of the mobile body of interest are determined against a composite null hypothesis of reverberation and ambient acoustic noise. The approximate BF processor is shown to be a time-varying quadratic form of array observations over the beam-delay space. We illuminate the sub-space processing of depth invariant modes at range and illustrate the BF Inferential approach on a few representative sound speed profiles. Performance in classic terms of probability of detection as a function of false alarm rate are presented. [This work supported by The Office of Naval Research.]

13. Passive acoustic source localization of marine mammals in hydrophone array recordings with time-domain beamforming

David Campos Anchieta (G), Electrical & Computer Engineering
Annamaria DeAngelis
John Buck (F), Electrical & Computer Engineering

Hydrophone arrays add a spatial dimension to underwater acoustic recordings, allowing both background noise attenuation and sound source localization. To infer the location of loud far-field sources relative to the array, time-domain passive beamforming compensates for the angle-dependent time shift between signal arrivals at each hydrophone.   This research tests broadband time-domain beamforming to obtain spatial information about the locations of sperm whale clicks recorded on a NOAA towed hydrophone linear array dataset recorded in the Summer of 2016. The high sampling rate of the recording allows the formation of many beams. The proposed algorithm identified the whale clicks, as well as their likely angle of arrival, by determining the steering angle maximizing the average output power of the time-domain beamformer. The relatively low computational complexity of the time-domain beamformer makes it more suitable for real-time applications when compared to parallel implementation of many frequency-domain beamformers.

14. Large Scale Parallel Rigged Telemetry Versus Large Scale Series Rigged Telemetry, which is Favorable?

Christian Fall (U), Electrical & Computer Engineering
Howard Michel (F), Electrical & Computer Engineering

Large-scale telemetry systems take in data from the outside world. They do this by being equipped with different types of sensors that can record data in an environment in which the sensor is designed with respect to the environment. Once data is collected, it is typically sent to a control station in real time where various software is used to analyze said data. Many telemetry systems are subjected to nonideal environments with regard to their electrical longevity, these environments include but are not limited to the ocean, the desert, the forest, and many more environments. Nature mixed with human interaction can cause problems in telemetry systems which cause them to break, which is then typically repaired by an electrical engineer. The circuit logic behind the system is partially responsible for many factors taken into consideration in the engineering method. These factors include but are not limited to efficiency, safety, and other individual factors that depend on the use case. Whether the device is rigged predominantly in series or parallel plays a large role in all of these factors.

15. Investigating Targets to Decrease Detection Probability for Infotaxis Experiments

Connor Kramer (U), Electrical & Computer Engineering
John Buck (F), Electrical & Computer Engineering

Abigail Fabian [nee Keith] (2022) found that the infotaxis search algorithm prevails in the presence of missed detections when compared to other common search algorithms such as Maximum A Posteriori (MAP). Her simulations found that with a 70% probability of detection, infotaxis was 100% faster than MAP. Attempts to replicate this success in physical experiments proved challenging as the HC-SR04 ultrasonic sensor had greater than 70% detection on existing Lego targets. Curved objects can reduce probability of detection by altering the effective surface area for reflections. Tests with wooden dowels of varying diameters found that the probability of detection can be reduced to 41 and 57.5%. Similar experiments with a golf ball found a probability of detection as low as 78%, quite close to the ideal 70% reported by Fabian. Physical experiments can replicate Fabian's simulations with these targets and the iRobot Create 2. The robot will search for one of these objects in a 1D linear grid using both MAP and infotaxis to test Fabian's results in a real-world experiment. [Supported by ONR MURI program]

16. Mitigating Risk of Cascading Failures in Storage Area Networks

Guixiang Lyu (G), Electrical & Computer Engineering
Liudong Xing (F), Electrical & Computer Engineering

Storage area networks (SANs) are a widely used and dependable solution for data storage. Nevertheless, the occurrence of cascading failures caused by overloading has emerged as a significant risk to the reliability of SANs, impeding the delivery of the desired quality of service to users. This poster presents static and dynamic load-triggered reallocation strategies to alleviate the cascading failure risk during the specified mission time. Two types of switches selection rules, respectively based on the load level and switch reliability, are studied and compared. Based on the SAN component reliability assessed using the accelerated failure-time model, the SAN reliability is evaluated using binary decision diagrams. A detailed case study of a mesh SAN is conducted to demonstrate and compare the performance of different cascading failure mitigation schemes in terms of the SAN reliability improvement ratio and resulting SAN reliability.

17. Design and Evaluation of a Toroidal Electroacoustic Transducer

Divyamaan Sahoo (G), Electrical & Computer Engineering
Austin Souza (G), Electrical & Computer Engineering
Michael Bisbano (G), Electrical & Computer Engineering
David A. Brown (F), Electrical & Computer Engineering

This project investigates the design and modeling of an electroacoustic sound source with a toroidal geometry with the goal of producing a closed-form analytical expression for the far-field acoustic radiation. Practically, such a (donut-like) geometry may be difficult to achieve although an approximation might be realizable with a short hollow piezoelectric cylinder (or ring) vibrating in extensional-circumferential mode. As the height-to-diameter aspect ratio is increased, the cylinder may be approximated by an array of coaxially aligned toroidal bodies. The computed directional factor of the radiation pattern will be compared to known results of similar geometry. (Work supported in part by the ONR (Office of Naval Research) and MUST Marine UnderSea Systems Technology research program.)

18. Spectral projection Model applied to Scattering of Electromagnetic Waves from Cylindrical and Ellipsoid surfaces

Vidyasagar Sivalingam (G), Electrical & Computer Engineering
Dayalan Kasilingam (F), Electrical & Computer Engineering

In radar, remote sensing and wireless communications, understanding the interaction of electromagnetic waves with the physical attributes of objects or targets is as important as estimating the far field scattered signal for detecting and identifying targets. The scattered far field patterns are estimated by calculating the induced current on the surface of the target. Understanding the relationship between the induced currents and the physical attributes requires an electromagnetic scattering model, which preserves the relationship between the two quantities within the model's numerical formulation. The Method of Moments (MoM) is the established method which is used to calculate the induced surface currents, but at the expense of time complexity. In this research, a novel new technique called the Spectral Projection Model (SPM) is developed and used to estimate the spectral signature of the induced current, while significantly reducing the running time. SPM reformulates the scattering problem as the projection of the spectral signature of the induced currents onto the spectral signature of the points on the target's surface. MATLAB simulations are used to calculate the induced surface currents and the scattered far field patterns using the SPM method for cylindrical and spherical targets. These results are compared with those from MoM to verify and validate the new approach. The results indicate that the accuracy of SPM is comparable with those from MoM. SPM is found to be significantly faster than MoM due to the efficient formulation of the numerical model. It is concluded that the accuracy and speed of the SPM technique provides the potential to use this model for addressing inverse scattering problems such as target synthesis and cognitive radar.

19. Inaccuracies in reanalysis products: A case study of the Arabian Sea from 2017 to 2018

Debarshi Sarkar (G), Engineering & Applied Science
Siddhant Kerhalkar (G), Estuarine & Ocean Sciences
Amit Tandon (F), Estuarine & Ocean Sciences

Air-sea fluxes in the Arabian Sea play a significant role in monsoon predictions. Reanalysis products serve as initial conditions for several forecast models and for climate analysis, making the accuracy of these products critical. Here, we quantify the biases of some well-known reanalysis products with respect to in-situ observations collected from four spatially distributed moorings in the Arabian Sea. We focus on an annual cycle of October 2017 to September 2018, including the Fall, the Northeast monsoon, the Spring, and the Southwest monsoon seasons (SWM). Our analysis also assesses the accuracy of these products in capturing the tropical cyclone Ockhi and the tropical depression ARB-01 which traverse this region at that time. All products predict lower wind speeds and a higher surface cooling during SWM. Biases in shortwave radiation and latent heat fluxes reach 200 W/m2 and 100 W/m2 respectively. High biases of 10 m/s and 4oC were also recorded in SST and wind speeds during the cyclone. These product biases may significantly impact their ability to accurately capture the variability and progress of the South Asian Monsoon and other extreme weather systems [supported by ONR].

20. Hindcast Output: An Exploration in the U.S. Northeast (2017-2019)

Adriano Giangiardi (G), Fisheries Oceanography
Changsheng Chen (F), Fisheries Oceanography
Lu Wang (P), Fisheries Oceanography
Siqi LI (P), Fisheries Oceanography

This study examined data generated by the Northeast Coastal Ocean Forecast System (NECOFS) between 2017 and 2019, focusing on the U.S. Northeast coastal area. This system integrates information from the atmosphere, rivers, and oceans to forecast conditions in regions like the Gulf of Maine and Georges Bank. We looked at the velocity of ocean currents, as well as temperature and salinity values, comparing them with both model predictions and real-world observations. Our findings confirmed several known patterns: there's a counterclockwise flow in areas like the Jordan Basin and Wilkinson Basin, a clockwise flow around Georges Bank, and a southward current along the western edge of the Great South Channel within Georges Bank. In simpler terms, we studied how water moves along the Northeast coast and found that our model's predictions matched well with what we know about these currents from previous research and observations.

21. Fracture Characterization of Adhesively Bonded Double Network Hydrogels

Davidson Joseph (G), Mechanical Engineering
Vijaya Chalivendra (F), Mechanical Engineering

A detailed experimental study is performed to study the static mode-I and mixed-mode fracture behavior of sticky double network (DN) hydrogels that are connected using H-bonding via photocuring. Novel fracture specimen configuration is developed to determine the fracture initiation toughness values under above fracture conditions using J-integral approach. Two kinds of DN gels are considered in this study: (a) amylopectin/poly-x-acrylamide (Amy/PxAAm), and (b) Amy/HEAAm, where HEAAm is N-hydroxyethyl acrylamide. The effect of the amount of acrylamide in each hydrogel on both mode-I and mixed-mode fracture initiation toughness is determined. A digital image correlation is used to obtain the strain fields around the crack-tip to understand the extent of non-linear process zone around the crack-tip. The strain fields are later correlated with fracture toughness values to explain the fracture behavior of these gels.

22. Mixed-Mode I/II fracture criterion of 3-D printed ABS-CF composites

Zhuoyuan Leng (G), Mechanical Engineering
Vijaya Chalivendra (F), Mechanical Engineering

In this study, an experimental investigation is performed to investigate mixed-mode fracture on fusion deposition modelling (FDM) printed ABS (acrylonitrile butadiene styrene) and carbon fiber reinforced ABS. A single-edge notch bending (SENB) specimen configuration is used to conduct mixed-mode fracture experiments. For each printing orientation, pure mode I fracture under symmetric three-point bending, mixed-mode I/II, and pure mode II under asymmetric three-point bending are characterized to obtain the mixed-mode fracture criterion for two materials. The effect of printing orientation on the mixed-mode fracture criterion will be discussed. The result exhibits an overall trend of decreasing K values with increasing printed orientations from 0° to 90° both in pure mode I and II, and the KII value are all around 2.2 MPa·√m. These findings reveal that the mixed-mode fracture criterion is significantly influenced by the printed orientations. In addition to experiments, computational simulations are being performed to model the mixed mode fracture behavior and validate the predicted fracture toughness values to that of experiments.

23. Measurement of Mode-I Fracture Toughness of Polyacrylamide-Amylopectin Hydrogels with Chitosan Interfacial Reinforcement Using a Novel Testing Method

Mohammed Shonar (G), Mechanical Engineering
Vijaya Chalivendra (F), Mechanical Engineering

Hydrogels are soft and water-rich polymer networks with tunable adhesive properties, that are extensively utilized in the biomedical field. Due to their bonding characteristics, certain hydrogel networks can adhere to a variety of surfaces, including skin tissue. In this study, single network hydrogels composed of Polyacrylamide and Amylopectin were photocured into adherents of T-shaped cross-sections and then bonded together to form 50mm long specimens. The interface of the adherents is reinforced with 200 µL chitosan solution consisting of average molecular weights of 1.5 kDa, 15 kDa, 250 kDa, 343 kDa, and a control group with no chitosan solution. The study investigates the effect of different chitosan molecular weights and pH levels (ranging from 2.5 to 4.5) on the mode-I fracture toughness. The mode-I fracture initiation toughness is evaluated using nonlinear J-integral fracture mechanics. It was observed that the chitosan with the highest molecular weight and pH level resulted in a 200% increase in fracture toughness compared to no chitosan reinforcement, which is attributed to crack tip blunting phenomena. Digital Image Correlation and R-Curve analysis are also presented.

24. The Association between Context-Inappropriate Sadness and Internalizing Behavior in Preschoolers

Hannah Boucher (U), Psychology
Robin Locke (F), Psychology

Emotion dysregulation, specifically sadness, is expected to increase the tendency for children to show internalizing behavior. However, it is unknown how children's ability to regulate sadness across different situations (CI sadness) puts them at risk. This study assessed parent reports of preschoolers' sadness across emotional contexts (n=156; 52% male). Child internalizing behavior was measured through both parent and teacher reports. Many children showed some CI sadness (80%), indicating that it may be a useful measure of dysregulated sadness. As expected, results indicated that the display of CI sadness was positively associated with internalizing behavior. The implications of these findings highlight the importance of considering the role of context of emotional responses as factors contributing to internalizing behavior. Future interventions intended to reduce preschooler internalizing behavior may benefit from considering these factors.

25. What the Health is Health Literacy?: Examining HL and Everyday Problem-Solving in Emerging Adults

Grace Fenner (G), Psychology
Brian Ayotte (F), Psychology

Health literacy (HL) is defined as the degree that individuals obtain, process, and understand health information. Although emerging adults (18-29 year olds) tend to score high on HL self-report tests, this is not reflected in qualitative focus groups where they often report feeling lost in the healthcare field and inexperienced interacting with health stimuli. This discrepancy between scoring high on self-reports, but verbalizing a lack of understanding implies an oversight in the field's existing methodology. Further, we recognize that most health problems require having practical knowledge to be able to solve them, which can be measured utilizing research from everyday problem-solving (EPS). EPS focuses on individuals' ability to solve problems that they interact with daily, including health related problems. Given that emerging adults engage in risky health behaviors, it is essential they can use health information to their best ability. In combining HL and EPS, we hypothesize that creating a new measurement can target relevant health problems that emerging adults encounter, exposing where and why the discrepancy in testing HL in emerging adults exists.

26. Impacts of Genre and Individual Differences in Working Memory Capacity on Situation Model Inference Construction

Madison Goncalves (U), Psychology
Trina Kershaw (F), Psychology

Prior research has shown mixed results regarding the effects of genre and working memory on reading comprehension, specifically on how people construct a situation model, which is a mental representation of a text that is integrated with background knowledge. To test the effects of genre and working memory on situation model construction, participants were asked to read short fiction, nonfiction, and poetry passages and answer questions which involved generating explanatory and predictive inferences about what they had read. The preliminary results showed no effect of genre or working memory on accuracy for either type of inference. We did find that participants were slower to answer inference questions for the nonfiction passage than the fiction passage and the poem. Further, there was a significant interaction between genre and working memory, in that participants with higher working memory were faster to respond to inferences about the fiction passage. These preliminary results will be discussed in conversation with students and educators alike to come up with new learning strategies to better promote reading comprehension across all subjects.

27. Longitudinal Analysis of Changes in Statistical Understanding across the Psychology Curriculum

Brandon Guarini (G), Psychology
Trina Kershaw (F), Psychology
Mary Kayyal (F), Psychology

Statistical reasoning is counterintuitive to new students, and students have difficulty understanding a range of basic concepts, including data representation and variability. We examined student exam and assignment data from two undergraduate Psychology courses – Statistics in Psychology and Research Methods – collected between Fall 2020 and Spring 2023. Analysis of these data reveal challenges that were present in both Statistics in Psychology and Research Methods, such as understanding repeated measures designs. Other challenges were present in Statistics in Psychology but became worse in Research Methods, such as understanding central tendency and one-way ANOVAs. In addition, other challenges emerged in Research Methods, such as understanding main effects and the slope in a regression equation. Further, we found that the number of semesters between Statistics in Psychology and Research Methods did not affect retention of statistics concepts. Based on these findings, we developed an educational intervention that was implemented in Statistics in Psychology in the Fall 2023 semester. Preliminary findings from this intervention and additional implications will be discussed.

28. Anger Expressions Linked to Chaotic Home Environments and Externalizing Behavior

Emily King (G), Psychology
Kelsey Botelho (U), Psychology
Ariel Then (U), Psychology
Robin Arkerson (F), Psychology
H. H. Goldsmith

Children exposed to environmental confusion may come to filter out situational input, leading to emotional processing deficits. Children who misread emotions may show anger unexpected for the context ("context-inappropriate (CI)"). Parents of 360 twins (ages 6-10) reported on CI anger, externalizing behavior, and environmental confusion. Children exposed to more environmental confusion had greater externalizing behavior. Further, CI anger mediated the association between environmental confusion and externalizing behavior. Findings highlight relevance of environmental confusion for emotion.