MAINE

2023 Student Symposium

Research and Creative Activity

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- Tolu Esther Alaba
- Julia Pitman
- Dorothy Klimis-Zacas

1053. Role of Protein Tyrosine Phosphatase Receptor Type Q (Ptprq) in Podocyte Structure and Function

- Omodasola Adekeye
- Daemon Dikeman
- Ritu Tomar
- Iain Drummond

1054. Exploring the Role of Reactive Oxygen Species Production in the Innate Immune Response to Influenza A Virus

- Hannah Lembree
- Eric Jestel
- Silvia Wright
- Keith Hutchison
- Benjamin King

1055. Utilizing Sulfloraphane from Broccoli to Treat IBD

- Ryan Wijayanayake
- Sue Ishaq

1056. Interactions Between Co-habituating Prophages Increases Expression of Mycobacterial Intrinsic Resistance Gene, whiB7

- Sarah McCallister
- Matt Cox
- Jaycee Cushman
- Keith Hutchison
- Josh Kelley
- Sally Molloy

1057. MYBL2 Coordinates Proliferation and Differentiation in the Developing Mammalian Cochlea

- Caryl Young
- Emily Burt
- Vidhya Munnamalai

1058. CTHRC1 Inhibits Adipogenic Signaling

- Matthew Siviski
- Igor Prudovky

1059. Characterizing the Role of Calcium Inhibitors in JC Polyomavirus Infection.

- Olivia Brunetti
- Avery Bond

- Melissa Maginnis

1060. Characterizing the Regulation of Neutrophil Reactive Oxygen Species During Influenza A Virus Infection

- Sarah Foust
- Brandy-Lee Soos
- Benjamin King

1061. Characterizing the Effects of Aging on Nuclear Transport in Yeast

- Remi Geohegan
- Dylan Madden
- Joshua Kelley

1062. Nanocellulose Based Foams For Low-Cost Disposable Medical Applications

- Dominic Kugell
- Sydney Sheehan
- Spencer Johndro
- Michael Mason

1063. Manipulating Virulence of C. albicans Through Administration of RBT1 Peptides

- Meg Caron
- Robert Wheeler

1064. Neutrophil Expression is Linked to NFkB Pathway Genes

- Wyatt Cannell
- Brandy-Lee Soos
- Con Sullivan
- Benjamin King

1065. Measuring the Enzymatic Activity of V. parahaemolyticus When Grown with Larvae of Black Soldier Fly (Hermetia illucens)

- Isaac Lambrecht
- Matthew Moyet

- Edward Bernard

1066. Interleukin-17 Receptor D Decreases Endothelial Activation and Leukocyte Infiltration but Does Not Affect Atherogenesis

- Shivangi Pande
- Igor Prudovsky

1067. Investigating the Role of the Electron Transport Chain in the Determination of Lifespan in Caenorhabditis elegans

- Timber Mattson
- Seth Ashby
- Suzanne Angeli

1068. BMB210: Determining the Identity of Antibiotic Resistant Bacteria in Compost

- Nnamdi Baker
- Lee Anderson
- Tanner Hardison
- Olivia Herman
- Ryan McAulay
- Sarah Morales
- Jennifer Newell

1069. BMB210: Identification of Antibiotic-Resistant Bacteria in Compost Bioreactors

- Nnamdi Baker
- Bella Butzgy
- Mason Canon
- Kaitlyn Doyle
- Lily Gainer
- Lyle Hansen
- Griffin McDevitt
- Karlene McMaho
- Chase Quirion
- Mary-Kate Smith
- Jennifer Newell

1070. Proteomic Differences in Perivascular Adipose Tissue During Cardiovascular Disease

- Caitlin Stieber
- Christian Potts
- Benjamin Tero
- Young Sun Lee
- Alli Roshni
- Lucy Liaw

1071. Analyzing GBS Prophage Genomes

- Sydney Brown
- Gavin Bressette
- Sophie Charles
- Katherine Southworth
- Melody Neely
- Caitlin Tetteh

1072. Function and Activity of Brown Adipose Tissue (BAT) in Cardiac Arrest

- Carolina Cora
- Breanna Morrill
- Mary Sorcher
- Joanne de Kay
- Elena Chepurko
- Vadim Chepurko
- David Gagnon
- Teresa May
- Richard Riker
- Sergey Ryzhov
- David Seder
- Matthew Lynes

1073. Stop! Viral Infection in the Name of Drugs: Assessing JCPyV Infectivity After Treatment with Potential Inhibitors

- Noah Burby
- Daisy Drinkert
- Patrick Fleming
- Sarah Foust
- Audrie French
- Kyle Murawski

- Hector Orellana
- Dorothy Smith
- Katie Southworth
- Sam Weafer
- Lauren Cusson
- Lucas Bennett
- Melissa Maginnis

1074. The Localization of Dystroglycan and Integrin Proteins Within Muscle Cell Membranes

- Mary Astumian
- Komala Shivanna
- Prakash Raut
- Clarissa Henry

1075. Pain-Induced Neural Plasticity Following Neonatal Trauma: the Role of Neural Heterogeneity in the Central Amygdala

- Megan Tomasch
- Mike Burman

1076. Determining the Effect of F-ATP Synthase Calcium Binding on Lifespan in C. elegans

- Arianna Hatt
- Marcus Ratz
- Suzanne Angeli

1077. Investigating Dendritic Spine Morphology as a Mediator of Cognitive Outcomes in Aged Diversity Outbred Mice

- Andrew Ouellette
- Jeremy Herskowitz
- Kelsey Greathouse
- Audrey Weber
- Niran Hadad
- Catherine Kaczorowski

1078. Regulation of Microtubule Dynamics During the Pheromone Response in Saccharomyces cerevisiae

- Loren Genrich
- Joshua Kelley

1079. Effect of Prophages on Mycobacterial Survival in Macrophages

- Katelyn Amero
- Sarah McCallister
- Caitlin Wiafe-Kwakye
- Sally Molloy

1080. Double-Edged Sword: Increased Survival in IAV Infected mpx Knockout Zebrafish Potentially Related to Differential Expression of Hydrogen Peroxide Genes

- Dominic Needham
- Emily Fraser
- Eleanor Carrolton
- Keith Hutchison
- Benjamin King

1081. Ensuring Reproducibility of Experimental Results Through Proper Imaging Methods

- Matthew Sarapas
- Samara Obenauer
- Felix Morrissey
- Ian Harden
- Karissa Tilbury

1082. Interactions Between Streptococcus agalactiae and Candida albicans Affect Persistence and Virulence

- Kathryn Patenaude
- Anna Lane
- Marc St. Pierre
- Robert Wheeler
- Melody Neely

1083. Establishing Rab27a as a Regulator of Vascular Reactivity

- Ashley Soucy
- Anne Harrington
- Larisa Ryzhova
- Abigail Kaija
- Benjamin Tero
- Christian Potts
- Lucy Liaw

1084. Prioritization of Non-Coding Cancer Drivers using MPRA

- John Butts
- Rodrigo Castro
- Sagar Gosai
- Steve Reilly
- Ryan Tewhey

1085. Effect of D93 Antibody on Cellular Migration in a Breast Cancer Cell 3D Spheroid Model Embedded in a Collagen Gel

- Zoe Vittum
- Jordan Miner
- Karissa Tilbury

1086. Improving Cancer Patient Access to Precision Medicines Using Molecular Diagnostics

- Michael Babcock
- Benjamin King

1087. Characterization of Total Polyphenolic Content of Natural Remedies used by Indigenous People

- Kyle Murawski
- Jennifer Newell-Caito

1088. Probing the Role of Serotonin receptors in the JC Polyomavirus Infectious Cycle

- Lucas Bennett
- David Winski

- Samuel Hess
- Melissa Maginnis

1089. Development of a Novel Luciferase Assay for Quantifying Viral Burden in Order to Evaluate Drug Efficacy in Zebrafish

- Samuel Weafer
- Brandy-Lee Soos
- Benjamin King

1090. Generation of Two Mechanistically Distinct Transgenic In Vivo Axolotl Cell-Ablation Systems at Various Developmental Stages

- Gabriela Johnson
- James Godwin

1091. Group B Streptococcus Prophage Accessory Protein Effects on Bacterial Fitness and Virulence

- Hannah Maurais
- Caitlin Wiafe-Kwakye
- Melody Neely

1092. Antimicrobial Agent Cetylpyridinium Chloride Exposure in Rodent and Primary Human Cells: Mechanisms of Mitochondrial Toxicity Revealed via Novel Toxicological Methods

- Emily Ledue
- Sasha R. Weller
- John E. Burnell
- Bright Obeng
- Brandon M. Aho
- Tetiana Systuk
- Juyong K Shim
- Samuel Hess
- Julie Gosse

1093. Uncovering Components of Pseudomonas aeruginosa Supernatant that Enhance Antifungal Drug Efficacy Against Candida albicans

- Desiree Tanner

- Kamri Sharp
- SIham Hattab
- Robert Wheeler

1094. Cell-type Specific Mechanisms of JC polyomavirus Infection

- Sophie Craig
- Michael P. Wilczek
- Aiden M. C. Pike
- Benjamin L. King
- Melissa Maginnis

1095. Role of Pattern Recognition Receptor Signaling in Immunity Against C. albicans Infection in Zebrafish

- Gursimran Dhillon
- Linda Archambault
- Robert Wheeler

1096. Comparison of MicroRNAs Between Ecologically Divergent Sparrow Species

- Kayla Barton
- Adrienne Kovach
- Brian Olsen
- Benjamin King

1097. Polymicrobial Interactions Affect Anti-fungal Treatment Efficacy

- Siham Hattab
- Robert Wheeler

1098. The Role of Diabetes Mellitus during Co-infections of Streptococcus agalactiae and Candida albicans

- Logan Christian
- Melody Neely

1099. ColorFlu Zebrafish: An In Vivo Fluorescent Influenza A Virus Infection Model

- Brandy-Lee Soos
- Dr. Benjamin L. King

1100. Novel Mycobacterial Prophage Genomes and Their Polymorphic Toxin Immunity Systems: A Tail of Tandem Prophages

- Eleanor Carrolton
- Alison Kueck
- Dorian Royal
- Sally Molloy

1101. Conditional Knockout of Celf4 from Mouse Sensory Neurons Induces Robust Mechanical and Thermal Hypersensitivity

- Madison Mueth
- Eliza Grlickova-Duzevik
- Peter Neufeld
- Jill Ward
- Christoph Straub
- Ben Harrison

1102. Uncovering Factors Involved in Bacterial-Drug Synergy Against Candida

- Allie Conner
- Siham Hattab
- Nikhil Vaidya
- Robert Wheeler

1103. MicroRNA Regulation of Neutrophil Inflammation during Influenza A Virus Infection

- Riley Grindle
- Brandy Soos
- Benjamin King

1104. Novel Drug Treatments Improve Influenza A Virus Infections in Zebrafish Measured by Respiratory Burst Assay

- Mykayla Weinstein
- Brandy-Lee Soos
- Benjamin King

1105. "Opp"-eration Nutrient Uptake: How the opp System Interacts with Prophages in GBS

- Katie Southworth
- Caitlin Wiafe-Kwakye
- Melody Neely

1106. Investigating the Effect of Navitoclax on Hematopoietic Stem and Progenitor Cells during Clonal Hematopoiesis

- Shawn David
- Jennifer Trowbridge

1107. The Effects of Boi2 Mutations in Saccharomyces cerevisiae

- Samuel Deelsnyder
- Joshua Kelley

1108. Environmental and Genetic Factors That Alters the Normal Macrophage Response to Pseudomonas aeruginosa

- Liz Saavedraperez
- Carol H. Kim
- Con Sullivan
- Benjamin L. King

1109. Using RNA Sequencing and Cloud Computing to Characterize How Defective Neutrophil Migration Impairs The Innate Immune Response to Influenza A Virus Infection

- Emma Boudreaux
- Eric Jestel
- Sarah MacLeod
- Steven Allers
- Brandy-Lee Soos
- Benjamin King

1110. PD-L1 Expressing Myeloid Cells Promote Bone Marrow Immunosuppression and Bone Loss with Diet-Induced Obesity

- Samantha Costa
- Sergey Ryzhov

- Moustapha Kassem
- Clifford Rosen

Physical and Mathematical Sciences

101. Asymmetric Organocatalysts: Synthesis and Function in the Augmentation of Oligonucleotide Stereochemistry

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): George Horvat

Faculty Mentor: Matthew Brichacek

Abstract: Antisense oligonucleotides (ASOs) are pharmacological tools that demonstrate selective inhibition of gene expression. These oligonucleotides are molecularly targeted agents capable of modifying specific biological pathways in order to stifle not just the symptoms of but also the propagation of disease. To be an effective drug, the ASO must have high bonding affinity for their RNA/DNA targets. However, the biological activity of the drug is dependent on the spatial arrangement of its atoms in three dimensions. Therefore, without proper adjustment to stereochemistry, unmodified oligonucleotides possess poor gene-silencing capabilities. To selectively tailor chiral drugs that optimize desired biological activity, new approaches were employed to synthesize enantiopure compounds. This study pursued the asymmetric synthesis of enantioselective chiral phosphonates with phosphodiester, phosphonamidite, and phosphonothioate backbones. To modify these molecules this project followed a two-step approach: 1) Asymmetric nucleophilic catalysts were synthesized and utilized to provide enantio-enriched products; 2) The enantioselective induction was determined by HPLC on a chiral stationary phase whilst structural analysis was performed by phosphorus NMR spectroscopy. The piece of the oligonucleotide puzzle that this project addresses, provides for the scientific community, a synthetic model by which the enantiomeric yield of these phosphodiesters can be optimized. Such implications aid in the process of providing effective pharmacological treatments that can be tailored to stifle specific genetic expression, paving the way to reality of human existence more void of the torments of our chemistry.

102. High Temperature and Harsh Environment Protective Coatings for Connections, Antenna Surfaces, Wireless Components, and Sensor Packaging

Submission Type: Poster

Submission Category: Physical & Mathematical Sciences

Author(s): Rihab Masmoudi, Brian Frederick, Luke Doucette, Robert Lad, Mauricio DaCunha, Carl Tripp

Faculty Mentor: Carl Tripp

Abstract: The economic impact of corrosion on the United States accounts for greater than $450 billion annually. The integrity of steel parts that operate under high temperatures such as turbines, reactors, and boilers is tested by sensors that need to maintain their functionality under these extreme temperatures, particularly Surface Acoustic Wave (SAW) sensors. In this work, we develop a process to apply kaolin as a protective coating material that can extend the lifetime of the sensors under high temperatures (>800 °C). Kaolin clay are platelets with high melting point (1750 °C) and the key is to have these platelets lie flat on the surface to provide a tortuous pathway for oxygen to permeate. To this end, we have developed a simple layer-by-layer approach to achieve highly aligned kaolin coatings on steel. The approach involves converting an anionic kaolin suspension into a cationic kaolin by slow addition of the kaolin into concentrated cationic polymer solution, followed by sonication. Sequential dipping of the substrate into the cationic kaolin suspension followed by dipping in the anionic kaolin suspension lead to the layer by layer growth of a highly aligned kaolin film. Evidence of these highly aligned films on various substrates is provided by infrared spectroscopy, X-ray diffraction and scanning electron microscopy.

103. Proofs and Applications of the Gaussian Integral

Submission Type: Poster

Submission Category: Physical & Mathematical Sciences

Author(s): Lucas Shepherd

Faculty Mentor: Dave Bradley

Abstract: The Gaussian integral is a well-known integral in mathematics with numerous applications in various fields. In this project, we provide a brief history of the Gaussian integral before presenting three different proofs of the integral, including those from Pierre Simon Laplace, Carl Friedrich Gauss, and a more recent approach from Timothy P. Jameson. We then explore how the Gaussian integral is used to find the normalizing constant of a normally distributed probability density function and the normal cumulative distribution function. We also discuss the connection between the Gaussian integral and the error function. Finally, we apply the normal probability density function to quantum harmonic analysis and the normalized quantum ground state. Overall, this paper provides a comprehensive overview of the Gaussian integral and its applications, including how it can be used to understand fundamental concepts in statistics and physics.

104. Ghost Connect-Net: A Connectivity-Based Approach for Deep Neural Network Pruning

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Mary Isabelle Wisell

Faculty Mentor: Salimeh Yasaei Sekeh

Abstract: Recent work has investigated the redundancy in deep Convolutional Neural Networks (CNNs) and how the number of neurons and filters can be reduced by pruning the less important ones. However, most current methods only consider the statistics of one layer at a time and ignore the effects of error propagation in the network. To resolve this, we introduce Ghost Connect-Net (GCNet), a companion network that monitors the contributions of the connections in the original network to the final response layer (FRL), where each layer is connected to every other layer in a feed-forward fashion. The architecture of GCNet is designed to ensure maximum information flow between the layers of the network to the FRL, by connecting all layers directly with each other. Each layer also receives inputs from the preceding layers and passes its own connectivities to the subsequent layers where the connectivities are combined through concatenation. We then measure the importance of the connections' contributions to the FRL by treating them as features and applying feature ranking techniques. Then, we backpropagate the importance of the neurons from the FRL to the earlier layers. The connections with the lower importance scores are then pruned. We validate our method through experiments with benchmark datasets, such as CIFAR-10, CIFAR-100, and MNIST. We analyze the information flow, and robustness of the network to evaluate GCNet.

105. An Investigation of Causes of Inaccuracy of Infrared Radiation Cameras for Large Scale Additive Manufacturing Applications

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Lucinda Slattery, Matthew Ireland

Faculty Mentor: Samuel Hess

Abstract: In additive manufacturing, accurate and reliable temperature data is needed for both real-time feedback for print operators and understanding the thermal and mechanical behavior for prediction and part quality characterization. The use of infrared radiation (IR) is an accepted practice to determine the temperature of a surface. Because thermal radiation is measured from a distance without contact, it is safe in high temperature environments, like 3D printing. This work began with an investigation of previously collected reported temperature values for multiple cameras during one print to determine camera reliability. The results showed a decreasing trend for cameras close to the printer's heat source, which was not reflective of the printing process, and a discrepancy across overlapping camera views for the same instance. Two more prints were studied to determine if this camera behavior was unique to that print and geometry. The analysis showed the same results across all three prints, with camera reported values having inconsistencies for a single layer, a subset of layers, and the scale of the print. All data analyzed was previously collected from 3 prints from different dates and from cameras exposed to different operating conditions, both physically and optically. Multiple possibilities for the camera's variation were explored, such as material emissivity and angle of incident radiation into the camera lens. The possible causes of reported temperature deviation explored did not explain the decreasing trend behavior and variation over the duration of the print. The IR cameras were determined to require further calibration and experimentation before reported temperature values can be treated as physical temperature values.

106. Analysis of Simulated Core Collapse Supernovae of Red Supergiant Stars

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Peter Manzella

Faculty Mentor: David Batuski

Abstract: A red supergiant star typically ends its existence in a core collapse supernova explosion. We study this process, from the starting point of collapse, to when densities become great enough for 'core bounce' to start the star-destroying shockwave, using computer simulations. Using a General Relativistic 1-Dimensional (GR1D) simulation code, various parameters of the star were analyzed in context of core collapse. A series of profiles of density, entropy, electron fraction, and several other parameters were created. The time of core bounce was recorded for each of the 10 models simulated, increasing with solar mass. The longest of these times was 342 milliseconds and the shortest was 201 milliseconds Densities were also shown to exceed nuclear density (~ 10^14 g/cm3), implying successful core bounce.

107. Functionalized Graphene Oxide for Water Treatment

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Bareera Hafeez, Erica Jennings, Manisha Choudhary, Onur Apul, Tomas Marangoni, Alessia Battigelli

Faculty Mentor: Alessia Battigelli

Abstract: Graphene Oxide (GO) is a derivative of graphene which has recently emerged as a promising platform for a wide range of applications such as catalyst support, sensing and biomedical application. Conceptually, GO can be considered as a single layer of graphite oxide and is conventionally produced by chemical treatment of graphite with oxidizing agents, followed by exfoliation in organic or aqueous media. This treatment results in physical samples containing few layers of GO containing (5-10 layers) presenting oxygenated functional groups such as carboxylic acids, hydroxyl groups and epoxides. Oxygenated groups are useful binding sites for both covalent and non-covalent modifications and can be used to tune the properties of GO. In this work we are exploring the potential of functionalized (f)-GO as a water treatment agent for the removal of organic and inorganic pollutants. We are testing the dispersibility of (f)-GO in water and are using IR spectroscopy to elucidate the structure of (f)-GO, study the location of the functional groups and evaluate which groups can be functionalized to enhance the properties of GO. Finally, we will be studying how organic functionalization affects the rate and efficiency of pollutants removal.

108. Thermal Stability of Next Generation Double Perovskite-Halide Optoelectronic Materials

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Ethan Cronk

Faculty Mentor: Nicholas Bingham, Robert Lad

Abstract: Current perovskite-based solar cells have efficiencies as high as 24%, but their reliance on toxic lead-based chemical compositions and lack of stability at elevated temperatures in air hinder their integration into the solar cell and sensor industries. In this project, a Density Functional Theory (DFT) computational physics technique was used to predict properties of a double perovskite Cs2AgBiBr6 material, which is lead-free, inorganic, and potentially more stable in harsh environments. A nanoparticle powder form of Cs2AgBiBr6 with its ABX3 crystal structure was supplied by collaborators from Dr. Feng Yan's group at Arizona State University and analyzed at the University of Maine utilizing temperature dependent X-ray Diffraction (XRD), Differential Scanning Calorimetry (DSC) under in-situ environmental gases up to 300◦ C, and X-ray Photoelectron Spectroscopy (XPS). We found the decomposition temperature to be near 250◦ C in air, above which the material changes into select phases and decomposition products. These results are encouraging for practical use of these double-perovskite materials in next generation optoelectronic applications. Additional work will investigate material stability under other environmental parameters including humidity, oxidizing gases, and long-term ultra-violet exposure. This work is supported by NSF grant #2127630.

109. On the Life of Emmy Noether and Her Contributions to Abstract Algebra

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Alexiis Fiore

Faculty Mentor: David Bradley

Abstract: Women have been underrepresented in the field of mathematics for a very long time. As a future mathematics teacher, I think it is important that we highlight the discoveries and contributions of female mathematicians with the same rigor as we do their male counterparts. By doing so, we can make the subject more appealing, relevant, and accessible to all students, and increase the representation of women in a field that has long been dominated by men. This paper will discuss one of the most influential mathematicians of all time, Emmy Noether, and her substantial contributions to mathematics and mathematical physics. After discussing Noether's upbringing, education, and life experiences, we will dive deeper into her works. Noether's specialty was abstract algebra, and in this paper we will discuss her work with Noetherian rings, ideals, and the ascending chain condition, as well as the implications these contributions had to the field of abstract algebra. We will also learn about Noether's work with invariants (properties of mathematical objects which remain unchanged under certain transformations), and the theorem that derived from her discoveries. This theorem, Noether's Theorem, is essential to the field of theoretical physics. By highlighting the works and contributions of mathematicians like Noether, we can help women gain the respect and recognition they deserve in the world of mathematics.

110. Rational Trigonometry: Trigonometry without the Trig

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Branden Dagenais

Faculty Mentor: David Bradley

Abstract: The origins of our current system of geometry and mathematics as a whole can be dated back for many thousands of years. As such it is sometimes necessary to re-examine these systems and determine if they provide the best basis for mathematical computations, research, and teaching. In this presentation I will be examining the system of rational trigonometry presented by Norman J. Wildberger in his book Divine Proportions: Rational Trigonometry to Universal Geometry. The goal of this system is to create an alternative approach to standard trigonometry and Euclidean geometry that holds certain advantages that the typical approach does not. Wildberger does this by defining base quantities that are purely rational and not dependent on functions such as trigonometric or root functions. Quantities such as distance and angle are replaced with quadrance and spread while trigonometric functions such as sine, cosine, and tangent, are replaced with spread, cross, and twist. By defining these quantities as rational functions of the points that make up a line in the cartesian plane we are able to obtain purely rational quantities allowing us to do typical geometric calculations in almost any field. The hope here is that we are also able to provide a stronger logical basis for trigonometry that allows aspiring students to more easily engage with and understand geometry and trigonometry on a fundamental level. This presentation seeks to summarize the system of rational trigonometry, outline various applications in different fields of mathematics, and determine if such a system is worth implementing.

111. Approximation of the Incompressible Navier Stokes Equations Using Finite Difference Methods

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Seth Harding

Faculty Mentor: David Bradley

Abstract: A partial differential equation (PDE) system is a set of constraints on the partial derivatives of an unknown multivariable function. These systems are commonly utilized in physics and pure mathematics, with notable examples being the Laplace equation, wave equation, and Navier Stokes equations. However, finding solution functions for these systems analytically is difficult, and a universal method for solving PDE problems does not exist.

This project centers around approximating the solutions to these systems using “finite difference” methods, in which the domain of the unknown function is approximated by finitely many points. In this context, the domain of the function takes the form of a set of possible locations in space, as well as a time. The function’s partial derivatives at those points are then approximated by Taylor expansion. Given uniformly spaced points in space, the accuracy and stability of these approximations can be ensured by choosing a sufficiently small spacing in the time domain.

In particular, the approximation method given by Alexandre Chorin in the 1967 paper “A Numerical Method for Solving Incompressible Viscous Flow Problems” is implemented and tested. The aim of this approach is to find steady state solutions of the incompressible Navier Stokes equations, which describe the flow of an incompressible fluid. A secondary system is considered, one which allows some compressibility in the fluid. This system, regardless of initial state, converges to a steady state solution of the original equations. Simulation results of this system can be compared to known solutions of the incompressible Navier Stokes equations, and the method can be readily extended to a variety of flow problems.

112. Introducing and Understanding the Fast Fourier Transform and its Applications

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Soojin Park

Faculty Mentor: David Bradley

Abstract: The Fast Fourier Transform (FFT) is an algorithm for computing the Discrete Fourier Transform (DFT) of a sequence of data points, which is actually a combination of trigonometric polynomials. The FFT has become an essential tool in signal processing, data analysis, and other fields due to its efficiency, which is the order of ($N \log N$) operations where N is the size of the data. The efficiency is developed by exploiting the structure of the DFT formula and using certain symmetries of the complex exponential terms. So FFT reduces the computation of a length N DFT from the order of (N^2) operations to the order of ($N \log N$) operations. The FFT can be implemented in several ways such as the Cooley-Tukey algorithm, Bluestein's algorithm, and the prime factor algorithm. The Cooley-Tukey algorithm is the most commonly used. The FFT has numerous applications including image and audio compression, fifth generation mobile network, and voice data analysis. In this paper, we introduce the Fourier series, the Fourier transform, DFT and FFT to show how they work in data analysis. We also show why FFT is preferred over DFT in some cases. Lastly, some applications of FFT are discussed.

113. Fourier Transforms and the Applications of Fourier Analysis

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Samuel Vaccaro

Faculty Mentor: David Bradley

Abstract: In the early 1800's a breakthrough in mathematical analysis of the natural world was proposed by a mathematician Baron Jean-Baptiste-Joseph Fourier, the Fourier Transform. While studying thermodynamics and attempting to analyze the transfer of heat of solid bodies, Fourier proposed that the wave-like pattern of the heat transfer could be simplified into a series of simple trigonometric(sine and cosine) functions. In this presentation I will focus on this discovery and mathematical derivation of this formula. Along with this I will explore the numerous applications of the transform and its importance to science and math today. On top of Fourier transforms alone, I will discuss the Cooley-Tukey Fast Fourier transform that was discovered by J.W. Cooley and John Tukey that enabled the long tedious computations of Fourier transform to be drastically reduced allowing us to more easily apply this process with very large data sets of specific trends that the transform can be applied to. In order to do this I will investigate numerous journals and articles about the history and mathematics of Fourier analysis and its applications. From this investigation I hope to gain a fuller understanding of Fourier Analysis and how I can apply it to my own interests like music and digital signal processing.

114. A Century of Pursuit: The History of the Prime Number Theorem

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Ryan Fitzmaurice

Faculty Mentor: David Bradley

Abstract: As x tends towards infinity, the number of prime numbers less than x is asymptotic to x/ln(x).

This relatively simple fact allows for numerous advances in cryptography, computer science, and mathematics. Most notably, prime numbers are used in secure transmission of data, allowing for banks, militaries, and individuals to quickly and securely send information. Without this ability, online banking, credit cards, and much of the internet would be unusable. In this paper, I will try to shed light on the work of the various mathematicians that helped to build one small part of our modern world; the prime number theorem.

The theorem is built out of many small contributions from mathematicians ranging from disabled Russian nobility to French peasants-turned monarchists to eccentric Hungarian Jews living in exile. This menagerie of humanity pushed toward the prime number theorem using methods from number theory, calculus, and other areas of mathematics, including blind intuition. In this presentation, I will open a window into the many persons, relationships, and schools of thought that allow us to make a statement as simple as the number of primes less than x is asymptotic to x/ln(x).

115. Newman’s Simple Analytic Proof of the Prime Number Theorem

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Matthew Birch

Faculty Mentor: David Bradley

Abstract: The prime number theorem is a problem that many mathematicians have approached. First proposed by Adrien-Marie Legendre in 1798, it wasn’t until 1896 that it was proved independently by Jacques Hadamard and Charles Jean de la Vallee Poussin. Since then, there have been numerous different proofs, each with their own method; From the elementary proofs of Paul Erdos and Atle Selberg, to the analytical proofs of Norbert Wiener and Shikao Ikehara.

Then in 1980, Donald J. Newman proposed his own analytical proof. He took issue with both the original proofs of Hadamard and de la Vallee Poussin, but also the more modern ones of Wiener and Ikehara. The first two proofs contained the issue of needing to estimate the value of the Riemann Zeta function at 1. While the second two proofs got around that, they are tied to Fourier transforms and thus are subject to Fourier analysis. Newman sought to provide a proof that avoids these issues and he did. The proof is very simple in structure and works as a series of observations about the following functions:

$$\zeta(s) = \sum_{n=1}^{\infty} 1/n^s$$

$$\varphi(s) = \sum_{p} \log(p)/p^s$$

$$\sigma(x) = \sum_{p \leq x} \log(p)$$

where $s \in C$, $x \in R$, and p prime.

116. The Error Function and Measurement Theory

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Alexandra Walsh

Faculty Mentor: David Bradley

Abstract: The error function, otherwise known as the Gaussian error function, is vital in experimental sciences because of its applications related to measurement theory. Measurement theory is a section of applied statistics that concentrates on improving the accuracy of measurements by evaluating previous measurement systems and developing new methods to accurately calculate various quantities. This paper will show the roots of measurement theory can be found in philosophy, but quickly gained footing in a mathematical sense as well, citing the error function as an example of such.

I will also work through the steps to obtaining the error function. The error function gives the probability that a measurement is a certain distance from the mean value of the variable's distribution which is found through integration of the normalized Gaussian function.

With its roots in the Gaussian integral, started by Carl Friedrich Gauss in 1809 and further developed by Abraham de Movire and Pierre Simon Laplace, the error function, and measurement theory, are especially useful properties when applied in physics, statistics, and probability. It is actually through attempts to study errors in statistical distribution that this came to be, with Laplace using the normal distribution in his error analysis. Through studying the errors found in mathematics the results found can be given greater validity and accuracy, thus improving future usage of the previous properties and equations.

117. Understanding Neural Mass Models and Brain Activity Using Nonsmooth Analysis

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Cadi Howell

Faculty Mentor: Peter Stechlinski

Abstract: Neural activity in the brain involves a series of action potentials that represent "all or nothing" impulses. This implies the action potential will only "fire" if the membrane potential is at or above a specific threshold. The Wilson-Cowan neural mass model is a popular mathematical model in neuroscience that groups excitatory and inhibitory neural populations and models their communication. This on/off behavior of the firing rate is typically approximated by a smooth sigmoid curve in this model, due to its differentiable behavior, but it is not the most accurate function to apply to neural activity. Motivated by this, a piecewise-linear (PWL) firing rate function has been considered in the Wilson-Cowan model in the literature. This function, however, is nonsmooth, and cannot be analyzed by standard mathematical theory. In this project, we considered the Wilson-Cowan neural mass model using a nonsmooth PWL firing rate function and analyzed its behavior using recently developed techniques from generalized derivatives theory. We calculated the sensitivities of the model parameters using lexicographic differentiation in order to determine the parameters that most impact this model across a set of initial conditions. Preliminary results show that in areas of high neural activity, the sharpness factor of the firing rate function is the most influential parameter but the initial conditions of each state variable have less of an impact and in areas of low neural activity, the initial conditions become more influential.

118. The Difficulty of Words in Wordle

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Aidan McEnaney

Faculty Mentor: David Bradley

Abstract: During the pandemic we saw a huge rise in the popularity of puzzle games, with games such as chess becoming more popular than ever before. Another such game that gained popularity recently was Wordle, a word guessing game in which players have six tries to guess a word that will reset every day. Wordle has built in functionality to share one's score and as such many share theirs on various mediums, such as Twitter. This paper presents a model which serves to predict the difficulty of any given word within this game. Via a thorough analysis of data scraped from Twitter it was possible to determine what factors had a correlation to the average amount of guesses that a word would take and what factors did not. Once these factors were obtained a linear regression model was built and the weights of the various coefficients were trained by the use of a gradient ascent algorithm. In its current state the model predicts that the word "eerie" would take an average of 4.49 guesses for users reporting their score to Twitter.

119. Sums of Powers of Arithmetic Sequences via Generating Functions

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Zale Rasco

Faculty Mentor: David Bradley

Abstract: Mathematicians have been interested in the sums of the first n powers since antiquity. Many ancient cultures had useful formulae for the sums of the first n natural numbers, squares, and cubes. The monumental discovery of a general formula for the sum of any power in terms of the Bernoulli numbers shocked the mathematical community in the 17th century. Recently, the method of generating functions has proven an effective direct approach to studying these sums. A more general problem is the sum of powers of an arbitrary arithmetic sequence, such as the odd numbers or the numbers counting by four. We adapt the method of generating functions to this broader problem of sums of powers of an arithmetic sequence. The generating function for these sums gives rise to a functional equation. Solutions to this equation are obtained in the form of recurrence relations and, eventually, an explicit formula.

120. Overview of Quantum Tunnelling

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Alexander Bair

Faculty Mentor: David Bradley

Abstract: Classical Newtonian physics cannot describe accurately the behaviour of sub-atomic particles. Quantum mechanics, or wave mechanics, first proposed by Erwin Schrödinger in 1926, solves this issue, by introducing mathematical explanations, and principles, for the motion of a sub-atomic particle, and their interaction with various environments. Within Quantum mechanics there exists the concept of quantum mechanical tunnelling as a consequence of wave-particle duality, first observed in 1927 by Friedrich Hund. Quantum mechanical tunnelling has a number of useful applications, including nuclear fusion in stars and scanning tunneling microscopy, first developed in 1981 by Gerd Binnig and Heinrich Rohrer. Sources were found through library resources. Much work has been done in the field of quantum mechanics and quantum mechanical tunnelling, and this project gives an overview of topics mentioned and applications.

121. The Colley Matrix Method

Submission Type: Exhibit

Submission Category: Physical and Mathematical Sciences

Author(s): Vittorio Grillo

Faculty Mentor: David Bradley

Abstract: The Colley Matrix Method is a sports ranking system notably recognized by the NCAA for being a major selector of the college football National Championship. Dr. Wesley Colley created the system as a way to rank sports teams in an unbiased manner, only factoring in a team's wins and losses rather than other factors such as scoring margins and "home-field" advantage. Particularly in college football, with over a hundred teams playing twelve or so games, there is no ideal or perfect strategy for ranking every team. Arguments can be made for more opinionated based rankings such as the Coaches and AP Polls, or purely statistical methods such as the Colley Matrix.

We will investigate Dr. Colley's purpose, process, and lasting impact for creating the Colley Matrix Method. Also, we will compare it to other similar mathematical models for ranking sports teams. The Colley Matrix has faced criticism due to multiple controversial ranking results since its inception in 1998. Specifically, there have been instances where the ranking system has chosen a different college football National Champion than all other major selectors. We will further discuss potential reasons for this and other strengths and weaknesses the system has.

122. Applications of Matrices in Cryptography

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Sera Bigelow

Faculty Mentor: David Bradley

Abstract: This project focuses on the applications of matrices within cryptography throughout the years.

Modern day cryptography is an amalgamation of many different fields including mathematics, computer science, physics and others. Nowadays cryptography relies heavily on mathematical theory through complex programming making it incredibly difficult to deconstruct. It is essential for many different and surprising everyday applications such as chip payments on cards, electronic commerce, and digital currencies such as cryptocurrencies. In addition cryptography is heavily used in military communications to ensure security. While before the 20th century cryptography focused on linguistic patterns, newer technology has made encryption of images as well as any other binary represented data possible. One could immediately see just how reliant much of our everyday life is on the use of cryptography.

I will be reviewing different applications such as Hill Cipher method, Advanced Hill Cipher Method, and Golden Matrices to see exactly how useful matrices can be in encryption. While these various methods share heavy commonalities between each other, they also hold a number of key differences which make one more practical for a situation than another. I will be working to see how to encrypt and decrypt both messages and images through all of these techniques, as well as determining their effectiveness and security in the process. Overall I hope to get an idea of just how useful matrices can be in this field as well as how secure.

Business

201. The Maine Brand Study: A Statewide Survey of Maine Business Leaders on the Competitive Advantage of the Maine Brand

Submission Type: Poster

Submission Category: Business

Author(s): Caroline Paras, Connor Blake, Erin Percival Carter

Faculty Mentor: Norm O'Reilly

Abstract: As a destination with the moniker Vacationland, the state of Maine has always incorporated fun and escapism as part of its identity. It has struggled, however, to convey that Maine is also a serious place to do business, one that is competitive with other states on taxes, regulation, and business climate. Over the last five years, Maine has invested in its natural resource assets – including farms, forests, and fisheries – as sources of innovation, entrepreneurship, and jobs. These efforts demonstrate a marked change from trying to make Maine more like other states, or a place to get away from real life, to investing in Maine as a unique brand. To explore whether the Maine brand confers a competitive advantage in the marketplace, we launched the Maine Brand Study, a statewide survey of business leaders on the following themes:

• To understand how Maine businesses describe the Maine brand.
• To evaluate how businesses incorporate the Maine brand into their mission and values, workplace culture, and the development of products and services.
• To examine the relationship between the Maine brand and firm performance, outlook, and commitment to invest in the state.

Our research provides a unique and critical examination on whether and how a state's branding efforts translates to perceived benefits among business leaders within that state, including corporate culture, market reception, and workforce development. The findings not only have direct relevance to stakeholders but contributes to the literature on destination branding and economic development.

202. PFAS and Outdoor Clothing: Investigating Consumer Awareness, Motivation to Change, and Messaging Effectiveness

Submission Type: Poster

Submission Category: Business

Author(s): Danielle Hall

Faculty Mentor: Erin Percival Carter

Abstract: PFAS represent an emerging threat to human, animal, and environmental health. Thus far, much of the popular discussion about PFAS contamination has centered on biosludge application on agricultural land or limited consumer product categories such as non-stick cookware or takeout food containers. However, contemporary outerwear – particularly that intended for outdoor recreation – is routinely coated in substances containing PFAS to make garments waterproof. This is the case even among brands with longstanding reputations for prioritizing health and sustainability. In this work, we examine consumer awareness of PFAS in outdoor clothing, awareness of alternatives to PFAS treated outdoor clothing, willingness to adopt PFAS free outdoor clothing options, as well as the most effective messaging for increasing consumer motivation to learn more about the risks of PFAS to personal, social, and environmental health. This survey research is one of if not the first exploration of evolving customer decision making processes regarding PFAS in outdoor recreation gear and among the first explorations related to consumer goods.

203. The Post-USMCA Dairy Industry: A Deep Dive into the Global and Local Dynamics of Free Trade Agreements

Submission Type: Poster

Submission Category: Business

Author(s): Nicholas Johnson

Faculty Mentor: Stefano Tijerina

Abstract: We researched the impacts of the renegotiation of NAFTA into the United States-Mexico-Canada agreement on the North American dairy industry. First, we researched the historical trade relationship between the United States, Mexico, and Canada. Our research in this section revealed that one of the catalysts for implementing USMCA was an increasingly unbalanced trade relationship between the United States and Canada, exacerbated by protectionist policies on the northern side of the border. We established that in the decade before USMCA's implementation, Canada's trade surplus increased by 1,445%, while the United States' trade deficit increased by more than 600%. Furthermore, in that time, the United States lost roughly 30% of its dairy farms. Next, we researched trilateral lobbying during the renegotiation process and explored the impact of the Dairy Farmers of America PAC along with the Dairy Farmers of Canada. We found that Dairy Farmers of America ostensibly gained the upper hand in the deal, but Canadian dairy farmers have found and exploited loopholes in the updated agreement. Nevertheless, our research showed that in the first full year after the implementation of the USMCA, the North American dairy market significantly expanded for US dairy companies, and Mexican dairy companies saw drastically more access to the Canadian market. At the same time, Canadian dairy exports to both Mexico and the United States plummeted. Lastly, we put the North American bloc in the context of the global dairy industry, specifically focusing on Europe and Asia. While our research establishes the early results of the renegotiation, further research is needed in the following years to establish trends in the trade data over a longer period of time.

204. Exploring the Influence of Work From Home and On-Site Benefits on Perceptions of Organizational Attractiveness

Submission Type: Poster

Submission Category: Business

Author(s): Mikayla Reynolds

Faculty Mentor: William Obenauer

Abstract: As a result of the coronavirus pandemic, traditional workplace practices and operations were disrupted, and a large-scale questioning of workplace conditions, employer support, and employee compensation has emerged. As organizations work to recruit and attract talent and retain current employees, they recognize the changing employee needs. COVID-19 isolation increased the amount of work-from-home offered, which may have led to non-complementary benefits within the same organization. The objective of this study is to identify the influence of work-from-home benefits and on-site benefits on perceived organizational attractiveness among soon-to-be college graduates (N = 275). This research was designed to understand how these variables factor into the perceived attractiveness of an organization in the recovering COVID-19 workplace and current job market. Organizational attractiveness has not been evaluated specifically as it relates to these independent variables in a study conducted to determine whether work-from-home has a moderating effect on on-site benefits. Through an experimental vignette approach, recruitment "careers" webpages were designed to test the four conditions established by the 2 (work-from-home benefits advertised: yes, no) X 2 (on-site benefits advertised: yes, no) experimental design and randomly presented to participants. Results indicated that both work-from-home and on-site benefits have a positive relationship to organizational attractiveness. Outcomes may be able to inform businesses on what the emerging workforce is seeking in a company and allow organizations to construct their compensation and benefits strategies to better compete for talent and create value for employees.

Education

301. Pro-Choice Abortion Signs: A Content Analysis of Signs at Rallies Since the Supreme Court Ruling in June 2022

Submission Type: Poster

Submission Category: Education

Author(s): Caitlin Crawford, Emily Amaral, Taylor Sullivan,

Faculty Mentor: Sandra L Caron

Abstract: Our research project focused on pro-choice abortion signs appearing at rallies since this summer when the U.S. Supreme Court officially reversed Roe v. Wade, declaring that the constitutional right to abortion, upheld for nearly a half century, no longer exists. Our research project involved a content analysis of the various pro-choice signs that appeared social media of these rallies and protests. Our research question was, "What themes emerged when reviewing pro-choice signs appearing across the country after the overturning of Roe v. Wade." Our content analysis of 100 pro-choice signs appearing at rallies and protests revealed a number of themes. Our findings and a discussion of implications will be presented.

302. Sex Education Provided by Apple: A Content Analysis of Sexual Education Applications for Teenagers

Submission Type: Poster

Submission Category: Education

Author(s): Colleen Ford, Alanna Chavaree, Sally Stead

Faculty Mentor: Sandra L. Caron

Abstract: This research project focused on sex education applications for teenagers. Due to the limited amount of adequate sexual education in schools, teenagers are likely looking elsewhere for this information. Teenagers often rely on social media for information, including mobile applications or "apps" for a range of issues, including sexuality. Our study sought to explore the range of sexual education apps and the content they portray. Our research questions included: "What sexual health apps are available for teens on iOS/ the Apple App Store? And more specifically, what topics and types of content are available on these sexual health apps?" Our content analysis of 100 sexuality education apps revealed a number of themes. Our findings and a discussion of implications will be presented.

303. Child Development Lab Schools at U.S Colleges and Universities: Comparing Characteristics and Costs

Submission Type: Poster

Submission Category: Education

Author(s): Seana Mackeldey, Kaiisha Pluard, Thomas Broadhead

Faculty Mentor: Sandra L Caron

Abstract: Our research project investigated child development lab schools at colleges and universities in the United States. A child development laboratory school is defined as a campus-based program that provides both childcare and hands-on opportunities for college students to work with children. Such lab schools are typically associated with early childhood education and/or child development degree granting programs. Our study sought to compare the characteristics and costs of such programs. The research question we sought to answer was, What are the common characteristics and costs of campus-based child development lab schools in U.S. colleges and universities?" Our content analysis of the websites for 100 campus-based child development lab schools revealed a number of themes. Our findings and a discussion of implications will be presented.

304. Back-to-School Post-Covid: A Content Analysis of Newspaper Coverage of the Major Issues Faced by Students, Teachers, Administrators, and Parents

Submission Type: Poster

Submission Category: Education

Author(s): Jacquie Mullally, Emma Carbone, Jordan Sullivan

Faculty Mentor: Sandra L. Caron

Abstract: In the Spring of 2020, U.S. schools shut down due to Covid-19. The lockdown affected students, teachers, and parents in different ways. Students moved to at-home online learning. Teachers had to adapt their in-person teaching methods to online. And parents had the challenge of balancing work with needing to support their children's online schooling at home. As schools began to reopen in 2021, students and educators socially distanced, wore masks, followed testing protocols, and offered a mix of online and in-person teaching. By the Fall of 2022, with vaccines available for school-aged children, school administrators made it a priority to go back to "normal" within school districts. Our research was a content analysis of newspaper coverage of back-to-school issues. Our research question was, What issues have the top U.S. newspapers focused on related to the return to school post-covid? Our content analysis of 100 newspaper articles revealed a number of themes. Our findings and a discussion of implications will be presented.

305. Fostering an Equitable and Inclusive Learning Community

Submission Type: Poster

Submission Category: Education

Author(s): Sean Sibley

Faculty Mentor: Kelley Strout

Abstract: Schools of nursing are charged with preparing a diverse nursing workforce. Equitable and inclusive learning environments support students from diverse backgrounds to ensure student success and degree completion. Faculty need to take ownership of classroom climates to foster community, humanize to leverage cultural capital, and design courses for power equity. The aim of this quality improvement project was to implement small teaching strategies to increase a sense of community. The sample included two cohorts of students in an adult-health course. Multiple interventions focused on sharing of self, giving voice, and active learning were employed. Faculty designed a unique survey with scale and open response items to measure community at two points in the term. Students were more likely to feel part of the community at the completion of the course. Respondents appreciated having a voice in developing the classroom community and felt like their social context mattered to the faculty. The active learning classroom was a heavily weighted variable for building community. Respondents that were repeating the course or identified as a "non-traditional" student felt less part of the community. These findings are limited as a small sample at a single public institution. Nursing faculty can practice these small yet meaningful interventions to reduce hierarchy and increase belonging.

306. Examining Equity-minded Search Committee Trainings to Mitigate Bias and Ensure Equity

Submission Type: Poster

Submission Category: Education

Author(s): Jade Laplante

Faculty Mentor: Leah Hakkola

Abstract: Institutions utilize search committee training to better equip participants with the tools needed to execute a fair search process. This study examines the ways in which equity-minded search training might assist participants in centering diversity and equity in their searches at one Predominantly White Institution. Findings shed light on how an intentionally designed equity-minded search training might serve as a mechanism to enable a more equitable faculty search process.

307. “It’s a College Town”: Understanding Community Colleges as College Access Change Agents in Rural Communities

Submission Type: Exhibit

Submission Category: Education

Author(s): Devin Franklin

Faculty Mentor: Kathleen Gillon

Abstract: In our research paper, we examine how the physical presence of a community college in one rural town shaped our participant’s ability to learn about, access, and participate in higher education. We utilized a life history methodology– a tool to used to gather rich data from one participant. Our literature base explored three key topics. First, we explored the relationships between rural towns and community colleges, and we saw that these institutions provide key services beyond educational attainment (Almond, 2020; Friedel & Reed, 2019; Gumprecht, 2003). In addition, rural-serving institutions provide cultural enrichment to local stakeholders (Gumprecht, 2003; Miller & Tuttle, 2007; Negrea, 2014). Finally, we found literature that showcased how community colleges filled an educational gap for high-achieving high school students (Gagnon & Mattingly, 2016; Rivera et al., 2021). Through our participant’s life history, we found that the physical presence of her local community college normalized college going. Furthermore, the partnerships between the community college and the local high school created an easy pipeline for students to receive some postsecondary education. Finally, the institution provided community support in such a way that it fostered future attendance. This study assists in understanding the role of rural community context and the capital present at the community level in shaping rural student’s college-going practices and behaviors. As such, it challenges dominant notions of what constitutes a college town and reinforces the important role that community colleges play in rural communities relative to college access and college-going.

308. Be A Tree - Pre-Service Teachers Reflective Practice of their Whole Identity

Submission Type: Poster

Submission Category: Education

Author(s): Virginia Dearani

Faculty Mentor: Victoria Bennett-Armistead

Abstract: I will present research findings from an action research project taking place in my Preservice Elementary Education Courses. The purpose of this critical narrative research study was to investigate how preservice teachers' practice of self-reflection on their whole identity, within the context of their preservice coursework, shapes their teaching philosophy as a future educator. I was curious to see how preservice teachers' understanding of their whole identity evolves as they move through two exercises, the "Be A Tree" tool and the Ancestral Story Project, in two preservice education courses; and to investigate how their practice of self-reflection shapes their teaching philosophy as a future educator. For the purpose of this study, I will define the "whole" identity concept as considering an individual's complex layers embodying their self-perceptions of their physical, cultural, social, spiritual, emotional, and mental aspects, (which includes, but is not limited to, academic cognition and memory).

Focusing on students work artifacts and reflective dialogue, I will present my findings at this symposium on the exercises to develop the Whole Teacher as we prepare preservice teachers to teach to the Whole Child. I will explore the potential "holes" within their "Whole," identity preservice teachers experienced as K-12 students, and are now trying to reclaim as future educators. Through storytelling and arts based exercises, the students will share their own stories and perspectives of wholeness and the importance of reflective practice on our whole identities as future teachers.

309. The Impact of Outdoor Learning: A Case Study

Submission Type: Poster

Submission Category: Education

Author(s): Heather Manchester

Faculty Mentor: Maria Frankland

Abstract: During the COVID-19 pandemic, schools in the United States were forced to think differently in order to engage students in their learning. Outdoor learning emerged as a strategy to keep students in school and as a positive way to support student learning. Data suggests that outdoor learning is a highly effective strategy for engaging students, increasing achievement, supporting social emotional learning, and that there are barriers that prevent teachers from engaging in outdoor learning with their students. As districts seek further resources and funding to support outdoor learning, it is important to understand the impact of outdoor learning on educator practice and to gauge to what extent inquiry-based, collaborative approach of outdoor learning influences the lessons in the typical classroom. This case study of an experiential learning program for fifth graders in a large rural school district seeks to identify the influence of participation in outdoor learning on teacher practices. The study will focus on teachers' perceptions of how outdoor learning has impacted their teaching practices, what they value about outdoor learning, and what they need for support in order to continue using outdoor learning with their students.

310. The Factors Impacting the Recruitment and Retention of Community Partners for an Extended Learning Opportunities (ELO) Program at a Rural Maine High School: An Exploratory Case Study

Submission Type: Poster

Submission Category: Education

Author(s): Britton Wolfe

Faculty Mentor: Maria Frankland

Abstract: Extended Learning Opportunities (ELO) are a personalized, inquiry-based, community-based, career learning pedagogical strategy geared toward helping high school students refine and focus their career exploration learning through internships, apprenticeships, job shadow experiences, and other “hands on” experiences outside of traditional classroom methodologies and timeframes. ELO is one initiative which is part of a broader trend toward school-community partnerships. This study will use an exploratory case study approach consisting of semi-structured interviews to explore and analyze the experiences and perspectives of community partners in a rural context. Specifically, research questions focus on the factors which caused community partners to want to volunteer in this capacity and the factors which are necessary to keep them engaged as stakeholders. It is hoped that insights gained from this research will be beneficial to education and community partnership programs which seek to benefit rural students in Maine and beyond.

311. Measures for Supporting First-Generation College Students with Healthy Strategies for Coping with Stress

Submission Type: Poster

Submission Category: Education

Author(s): Emmanuel Duodu

Faculty Mentor: Elizabeth Allan

Abstract: First-generation students in U.S. colleges encounter challenges that can be stressful for them. As a first-generation student myself, I can relate to these experiences. As the population of first-generation students continues to grow, it is imperative for colleges to learn how to better serve them. Given this backdrop, the purpose of this study was to gather information about interventions five postsecondary institutions are utilizing to support first-generation students in coping with stress while in college. Findings revealed that these institutions are expanding the support offered to first-generation students with opportunities for stress reduction through emotional support animals (drop-in canine therapy), counseling services, and art based, psycho-educational are popular means of safeguarding first-generation students' well-being in college. The investigation also revealed that Cognitive Behavioral Therapy (CBT) coupled with breathing-in exercise is effective but underutilized. Thus, I concluded that basic strategies to support first-generation students on campus are not fully implemented. It is important that campus professionals in college become more familiar with first-generation student demographics, trends in enrollment, and retention to better support and provide resources for overcoming stress. If implemented, these strategies can help create a more optimal learning environment and stress reduction for first-generation college students which may improve their persistence in college.

312. Multilingual Learner Disproportionality in Intellectual and Developmental Disability: Practitioner Recommendations

Submission Type: Poster

Submission Category: Education

Author(s): Abdur Rehman Tariq, Melissa J. Cuba

Faculty Mentor: Joshua Taylor

Abstract: This presentation shares key findings from a systematic review on multilingual learners disproportionately identified under intellectual and developmental disability categories. Implications of these findings for practitioners will be discussed, along with those for future policy and research. Multilingual learners are overrepresented in special education services, which can negatively impact their academic and social development. However, little research has explored the extent of these disparities for multilingual learners under intellectual and developmental disabilities. This systematic review analyzes and synthesizes research to examine the degree to which multilingual learners are disproportionately identified under intellectual and developmental disabilities categories and provides a meta-analysis of disproportionality predictors. Through this analysis, we shed light on extant literature, individual and systemic factors associated with this type of disproportionality, and what practitioners can do to mitigate it. After providing background for the study and the results of the review, practitioners will gain useful knowledge related to implications for practice. These implications will be categorized into three different stages: referral process, eligibility process, and after identification process. Practitioners will be provided with key strategies to mitigate disparities and guiding pieces of information specific to each process. Participants will develop a better understanding of multilingual learner disproportionality, policy informing identification, data trends, and implications for future practice. The presentation centers on the experiences of multilingual learners and their families in relation to disproportionate representation in special education, providing educators with a deeper understanding and strategies to ameliorate inequities. Furthermore, this presentation is based on a systematic review of 13 peer-reviewed articles that met inclusion criteria, followed by a qualitative and quantitative meta-analysis of the included findings. The presenters followed the guidelines outlined by PRISMA-P and reviewed 294 potential articles across nine research databases using inclusion and exclusion criteria. Each text was first screened by title and abstract before the full text reviewed by two presenters at each stage, resulting in 92.9% and 92.3% interrater agreement across both phases. Researchers identified 13 peer-reviewed articles which met inclusion criteria, followed by qualitative and

quantitative meta-analysis of the included findings.

313. Restorative Mindsets: How Elementary Educators Come to Hold and Maintain a Restorative Mindset Toward Students

Submission Type: Poster

Submission Category: Education

Author(s): Ashley Reynolds

Faculty Mentor: Ian Mette

Abstract: Elementary school personnel have both an ethical and legal responsibility to shift disciplinary practices away from exclusion and towards restoration. In order to face the adaptive challenge of increasing teacher self-efficacy around behavior management, a restorative mindset can be developed and maintained. The development of a restorative mindset among elementary school staff has the potential to alter outcomes for the adults who care for students and for systems hoping to retain talented, invested staff. This research explored the attitudes and beliefs necessary to build a restorative mindset in adults who work with students in the K-5 grade span. This research also uncovered the supervisory practices which support the development of a restorative mindset. Interviews with members of a restorative practices leadership team in a Maine public elementary school were conducted as the primary data source for the case study. The findings from this case study will provide individual, school, and system-wide leaders with sensible supervision points of interest which support professional growth and preservation at the teacher (staff) level, such that these individuals build and maintain restorative mindsets.

314. Examining the Impact of Implementation Fidelity Mandates on Instructional Practices and Student Success

Submission Type: Poster

Submission Category: Education

Author(s): Anita Hopkins

Faculty Mentor: Ian Mette

Abstract: Schools in our country have been under fire since the 1983 publication of a report titled A Nation at Risk: The Imperative for Educational Reform. This report was followed by the No Child Left Behind Act in 2001, Common Core State Standards in 2010, the Race to the Top reform initiative from 2009 to 2015, and the Every Student Succeeds Act in 2015. In light of these measures, and with the ensuing increased emphasis on inflexible accountability measures and a myriad of school improvement models, schools often turn to scripted commercial programs as a vehicle to improve student achievement. Teachers are frequently given pacing schedules that force them into moving instruction forward regardless of whether their students have mastered skills. Rather than putting teacher judgment at the center of classroom decision-making, this hands instructional decision-making over to the authors of commercial programs – authors who have no intimate knowledge of the actual students in any given classroom and who often view learning and assessment through a deficit-perspective, with a limited and industrialized view.

Through semi-structured interviews with Maine County Teachers of the Year, this qualitative study examines practices of K-8 exemplary teachers regarding pedagogical practices and instructional decision-making and explores how those practices and decisions relate to fidelity to commercial programs as well as teacher perceptions of autonomy and self-efficacy. This study will further serve to inform leadership practices regarding the implementation of commercial instructional programs and the design of professional development opportunities that prioritize student learning over prescribed teaching practices.

315. Developing Concept-Focused Thinking in High School Science Learners

Submission Type: Poster

Submission Category: Education

Author(s): Kate Bizzak

Faculty Mentor: Tammy Mills

Abstract: This is an action research project conducted by a classroom science teacher in a public semi-urban high school in Michigan, investigating the research question "How can we develop concept-focused thinking in high school science learners?" For this study, concept-focused thinking was defined as (a) recognizing the value of sharing ideas-in-progress and being willing to share them, and (b) emphasizing concepts rather than memorized facts or processes, as shown through the use of language that refers to patterns, cause and effect, and/or generalizations of studied and novel phenomena. Participating students are members of mixed-ability general education conceptual physics classes. Data collected included lab reports, exit tickets, and teacher-researcher observations, and was coded to identify indicators of concept-focused thinking. During the study, the teacher used concept-focused language in questioning and instruction, and provided models and scaffolds to support students in using similar language. Preliminary findings indicate that students increased the number and variety of concept-focused language they used, and that they were more comfortable sharing their thinking. It was also noted that these findings did not correlate with student academic success as measured by scores on formal class assessments. These findings indicate that concept-focused thinking is accessible to all students, and that high-level achievement in disciplinary content is not required for them to do so. This has implications for the way we provide science education in mixed-ability public high schools, the priorities we have for students in these classes, and opportunities for real-world relevance to engage all students.

316. Examining how Teacher Educator Feedback Shapes Social-justice Pre-service Teacher Development

Submission Type: Poster

Submission Category: Education

Author(s): Emily Hamby

Faculty Mentor: Rebecca Buchanan

Abstract: This is part of a multi-phase project exploring social-justice teacher development in preservice teacher education coursework using a framework that examines teacher development along a continuum that includes awareness, inclusive practices, critical practices and transformative practices. This phase of the project examines how teacher educator feedback on a written instructional plan shapes preservice teacher learning along this continuum. Preservice teachers were tasked with creating an integrated instructional unit that includes English Language Arts content, Social Studies standards, and Social Justice standards. The teacher educator provided written feedback on each component of the unit design in an iterative fashion. For analysis of teacher educator feedback we developed a responsive qualitative coding scheme that explores both the content of the comments as well as their language function. This scheme includes four content codes: Social Justice, Making Content Accessible, Instructional Strategies related to Social Studies or Writing, and Integration. The language codes include Affirmations, Questions, and Suggestions. I am being responsive to patterns that arise during the analysis process. This allows for examination of both what and how teacher educators provide feedback. Coding is ongoing, but I expect to be able to share some initial themes seen from deductive reasoning regarding the focus of the teacher educator feedback such as the frequency of affirmations, or how questions are used to make suggestions as well as the frequency of comments on the different content areas coded. In addition I will share ongoing inductive reasoning for further exploration of trends that arise in the data.

317. An Equity-Oriented Research Practice Partnership

Submission Type: Poster

Submission Category: Education

Author(s): Madeline Howorth

Faculty Mentor: Rebecca Buchanan

Abstract: In collaboration with a local school district (LSD), the University of Maine (UMaine) College of Education and Human Development (COEHD) has initiated a research practice partnership (RPP) to form a collaborative relationship to address and strengthen diversity, equity, inclusion, and belonging (DEIB) efforts within the school district. Specifically, based on the requests of LSD, the UMaine COEHD is developing a collaborative equity audit that would be developed with the LSD and provide meaningful quantitative and qualitative data to inform future DEIB efforts within the school district. This equity audit includes a climate survey that will be distributed to faculty, students, and parents. It also includes interviews with administrators, teachers, and students about DEIB related efforts and needs. Finally, it includes quantitative analysis of student data broken down by subgroup to identify existing inequalities.

318. The Impacts of Feedback on Teacher Professional Growth

Submission Type: Posters

Submission Category: Education

Author(s): Eric Hutchins

Faculty Mentor: Ian Mette

Abstract: Schools are constantly looking at ways to improve student performance. The current teacher evaluation system in Maine is used more for accountability measures than for fostering professional growth. Students' current needs are different than before the pandemic, and teachers are discovering that students are academically behind where they should be. As such, Maine educators are at a crucial time to learn what is needed to help students now rather than continue to have them fall behind. A vast amount of knowledge with great potential to enhance professional learning and growth is available when teachers seek the perspective and feedback of students and peers, something that is currently missing from Maine teacher evaluation systems. This study examines how feedback from these sources impacts professional growth, student learning, and educator opinions about its role and value in the evaluation process. Teachers who do not seek the knowledge of students and peers are prevented from opportunities to design instruction that keeps pace with the changing needs of students and their schools. As such, this study hopes to find how formative feedback can impact the professional growth of teachers, improve student learning, and develop implementation strategies for teachers to benefit from formative feedback.

319. Addressing the Educational Leadership Crisis: The Factors that Lead to Principal Retention

Submission Type: Poster

Submission Category: Education

Author(s): Bill Tracy

Faculty Mentor: Ian Mette

Abstract: The United States (US) is facing a crisis in Educational Leadership that is having a negative impact on schools across our nation. Principals are leaving their administrative positions before they have a chance to make lasting positive changes. This cycle leaves schools constantly in flux as they continue to rebalance and reorganize after each new leader steps into their building. As a principal arrives in a new position they work to gain an understanding of the school processes and procedures, meet and develop relationships with the staff, get to know the students, parents and school community. This takes time, approximately five to seven years, and with principals staying an average of fewer than four years, schools are caught in an unhealthy cycle where they can never fully gain traction with one principal before bringing in a new leader with new ideas.

There have been a variety of studies over the last 15 years that focus on the reasons why principals leave their positions . Much of this work has been on a large scale, with a quantitative study to look at the reasons that lead to principal turnover. This dissertation will study the factors that lead to principal retention investigated from the personal experiences and stories of principals in one Northern US state. I will be using a qualitative approach, interviewing principals who have been in their current position for a minimum of five years. The goal is to learn the factors that lead to principal retention and then share those findings with principals, district leaders and principal preparatory programs.

320. Teaching Comprehension Through Visual Literacy

Submission Type: Poster

Submission Category: Education

Author(s): Katherine Bishop-Dunphy

Faculty Mentor: Susan Bennett-Armistead

Abstract: The objective of this presentation is to call attention to the increasing difficulties our schools are having teaching comprehension, discussion, and analytical skills. This poster session will focus on a literature review around using artwork to teach comprehension skills in elementary classrooms. For the purpose of this presentation there are 17 articles dating from 2001 to 2020 analyzed for effective teaching practices connecting critical thinking skills to art analysis. The findings of this literature review suggested that using artwork can be an effective way to facilitate the instruction of critical thinking skills (Housen, 2001-2002). Additionally, when using artwork to teach critical thinking skills, classroom teachers noticed that students' communicative skills, self-expression, and thinking skills were enhanced (Rautiainen & Jäppinen, 2017) and that a student's comprehension of a text are enhanced when applying visual literacy skills (Pantaleo, 2017). However, while students' learning outcomes may be positively influenced by visual literacy, it is worth noting that multiple researchers recommended that children should be given direct instruction about how to analyze an artwork before the activity becomes internalized. Therefore, the instructor needs to have a strong understanding of visual literacy (Rautiainen & Jäppinen, 2017) and the ability to facilitate the conversations (Papen, 2020). This poster presentation will address recommendations for practicing teachers such as what artistic elements have been identified in literature discussions, the use of wordless picture books, and meaning making skills.

321. How Can We Make Formative Assessments More Equitable for English Language Learners?

Submission Type: Poster

Submission Category: Education

Author(s): Carleen Goodsell

Faculty Mentor: Tammy Mills

Abstract: The purpose of this study was to determine if scaffolding formative assessments in 5th grade science and reading classes would allow multilingual learners to demonstrate their knowledge and understanding of the content better than non-scaffolded assessments. The main goal was to scaffold formative assessments based on the WIDA Can Do Descriptors by Domain, Proficiency Level, and Key Uses of Language: Grade 4-5 for students at 2 different ESOL levels and see if they did better than on the non-scaffolded parts of the assessment. The research hypothesized that student performance would improve on the scaffolded parts of the formative assessments. Participants included 17 fifth graders receiving ESOL services in a Title 1 public school. Eleven of the participants were ESOL level 3 and six participants were ESOL level 4 as identified by WIDA Access. Findings show that for some students the scaffolding helped them improve their performance and show their knowledge, while other students did not need the scaffolding to help them. Students who previously did not perform well on the non-scaffolded reading assessments, scored higher on the same items when scaffolded In science it was the opposite, more students who scored between 80% and 100% on the non-scaffolded parts either went up or stayed the same on the scaffolded parts. This study was limited to just 17 students and 4 quizzes per subject over an eight-week period. It was also limited because they were short assessments, only 4 – 6 questions each. Because of these limitations, the scaffolded question types were different between the scaffolded and non--scaffolded parts. Research can be continued by giving quizzes that are not scaffolded and then using the same question types (and in science the same topic) to give scaffolded quizzes. This method would allow an apples-to-apples comparison.

322. The Spark That Ignites: An Autoethnographic Journey Towards Agency and Choice-Based Education

Submission Type: Poster

Submission Category: Education

Author(s): Katie Truesdale

Faculty Mentor: Ian Mette

Abstract: This autoethnography details an educator's journey towards the implementation of choice-based education – the amalgamation of a life dream – and what happened leading up to that actualization. Through analytic reflexivity and narrative inquiry, this qualitative research will explore various educational contexts and perspectives as it seeks to unpack conditions ripe for agency, choice, and examining more asset-based approaches to schooling. First, I will explore the influences leading up to the implementation of a choice-based educational context ripe for student and educator agency. I will document the educational contexts that occurred throughout this journey and the perspectives therein. Second, I will recount how I built a choice-based educational system – and highlight the stories therein. I will then explore the conditions leading up to and through its development and the experiences centered around agency and deconstruction efforts in school. Lastly, I will investigate the question what are the implications for school leaders as they consider developing choice-based education systems, especially as it pertains to practice, research, and policy. It is the intention that this research brings a layer of hope that revolutionizing education – towards a more equitable system – is possible.

323. Reaffirming There is No “I” in Team

Submission Type: Poster

Submission Category: Education

Author(s): Melissa Lyons-Vitalone

Faculty Mentor: Ian Mette

Abstract: Federal and state special education laws and policies mandate the provision of public education for students with disabilities to be conducted in the Least Restrictive Environment (LRE), yet these students continue to face inequities being educated alongside their non-disabled peers. If disabled students are not able to make progress in the general education classroom with accommodations and modifications in place, they will have an Individualized Education Plan (IEP) which provides services outside of the general education setting. Their IEPs are developed by teams that are composed of various individuals including educational professionals, parents, and the student, if appropriate. To date, IEP team dynamics have not been well studied. Fortunately, there is a wealth of literature on group functioning in relation to group decision-making tasks which can be applied to the IEP team. This comparison case study research will call on this literature to examine IEP team dynamics from the lens of special education directors and IEP meeting facilitators. Interviews will be conducted with special education directors and IEP facilitators in Maine and New Hampshire to examine facilitation techniques in relation to inclusionary decisions in both states as well as to identify common barriers to inclusive decisions. Maine and New Hampshire have wide variability between their publicly reported LRE data yet share many similarities in geographic make-up, making comparisons more fruitful. Analysis of the results will be viewed through a conceptual framework aimed at understanding information sharing during IEP team decision-making meetings.

324. Reading Development in Adolescents and Adults: Development of a Technology-based Instructional Tool (R-Tech)

Submission Type: Poster

Submission Category: Education

Author(s): Nicole Cortez, Donato Apon, Raven Goodell, Lakshmana Silva, Hannah Yelle

Faculty Mentor: Sara Flanagan

Abstract: Low literacy is a difficulty millions of adults in the United States face. Data published by the U.S. Department of Education indicate that 52% of U.S. adults aged 16 to 65 experience some difficulty with English literacy, reading at or below a sixth-grade level, and as many as 19% - over 40 million people - may be considered to have low literacy or functional illiteracy, indicating difficulty reading short texts or understanding basic vocabulary (U.S. Department of Education, 2019; Barbara Bush Foundation for Family Literacy, 2020). Low literacy creates many challenges for adults; they may be less likely to find competitive employment, manage their family's health and finances, or complete common tasks in day-to-day life, such as reading directions. Despite the prevalence of adulthood low literacy and the significance of the disadvantages it creates, there exist few educational opportunities or resources for adults in need of remedial literacy instruction; existing literacy tools are targeted heavily towards children. To address this problem, we developed R-Tech (Reading Technology), a remedial reading and fluency development application specifically designed to meet the needs of adult and older adolescent learners. R-Tech enables learners to build fluency through intense, repetitive practice and instruction in an age-appropriate and accessible application environment. Instructors can also use R-Tech to observe their students' progress and design exercises to address each student's individual learning needs. We utilize principles of agile software development, accessible computing, and research in fluency development to deliver a simple, portable, and user-friendly application, the first of its kind in adult reading instruction tools.

325. The Relative Age Effect and Ensuring Student Success Regardless of Birth Month

Submission Type: Poster

Submission Category: Education

Author(s): Geoff Bruno

Faculty Mentor: Maria Frankland

Abstract: This mixed methods study examines the degree to which the relative age effect impacts student achievement outcomes for students K-12 in Scarborough Public Schools. The relative age effect refers to the impact differences in age among students in the same grade cohort can have on performance in school. Students who turn five in the months just prior to the eligibility cut-off date for starting Kindergarten (October 15 in Scarborough, ME) are nearly one year younger than those who are born in the months immediately after October 15th. In addition, there are parents who choose to delay their child's enrollment in Kindergarten for one year, a decision called red-shirting, which can serve to make a child who otherwise would have been one of the youngest in a grade cohort, now one of the oldest. The primary quantitative part of this study will compare student achievement results, specifically Maine Educational Assessment (MEA) scores in Math and Language Arts for Scarborough students in grades 3rd, 5th, and 8th grades. Achievement for students born in the months of July, August, and September will be compared to results for those born in November, December, and January over the course of a six year period: 2014-2019. A longitudinal analysis will also be completed for one student cohort as they move through the grades, from 3rd to 5th to 8th grade, to track any changes in performance based on birth month and relative age. A parent survey will be disseminated among all Scarborough parents with students in the K-2 schools to respond to questions regarding their decision-making for when to enroll their child in Kindergarten. An analysis of survey results, including an open-ended question around when their child is ready to attend school, will attempt to ascertain the degree to which parents in Scarborough consider red-shirting as a means to ensure greater success for their child in the classroom.

326. Multi-Hand Collaborative Digital Spatial Painting and Embodiment in Geometry Diagrams

Submission Type: Exhibit

Submission Category: Education

Author(s): Camden Bock, Brooke Howlett, Joshua Bohm

Faculty Mentor: Justin Dimmel

Abstract: In school geometry, diagrams are often inscribed on two-dimensional surfaces like paper, whiteboards and computer screens. With immersive virtual reality environments, mathematical diagrams can be digitally rendered in three-dimensions at human-scale. Digital spatial painting tools can support learners interact with these diagrams simultaneously with multiple hands, including with three or more hands in collaborative settings. We report on a study where learners worked in pairs to coordinate their use of multi-hand spatial painting tools to make mathematical diagrams. In semi-structured interviews, participants had access to a collaborative spatial painting environment where they could use a multi-hand painting tool for a total of one hour. Participants were given prompts similar to "how many ways can you make a cylinder." We describe how learners' inscriptions embodied mathematical relationships and allowed learners to center themselves within diagrams, including solids and surfaces of revolution. Our analysis suggests that the design of spatial diagramming environments should consider the opportunities for embodied connections afforded by large-scale, collaborative, and multi-handed interactions. Our exhibit includes a demonstration of the virtual spatial painting environment.

327. Understanding The Role of a Writer's Physical Location and How it Perpetrates Their Habituated Practice

Submission Type: Poster

Submission Category: Education

Author(s): Kursten Massey

Faculty Mentor: Mary PlymaleLarlee

Abstract: The objective of this project is to understand what role a writer's external physical location plays in perpetuating their own habituated practice and how understanding this role can improve student's understanding of their own writing habits. Often readers simply read the writer's work and it can be difficult for readers to imagine the various elements that shape the author's writing. However, understanding what role a writer's physical location plays in perpetuating their own habituated practice helps education researchers build an understanding that "physical space creates an embodied memory for and through writing, which influences their academic identities" (Pigg, pg. 268). I hypothesize that not only does the student writer's emplacement shape their habituated practice, but the externalization of their texts do as well; "For writers, this externalization decreases the amount of material they must remember and attend to while composing (reducing cognitive load) and allows them to focus attention on limited issues" (Bazerman 4.1, pg.61). I will draw on scholarly articles and case studies to further my understanding of habituated practice which "also explains the struggles more proficient writers experience when they have practiced certain genres for years and then try to deploy their abilities in new settings" (Anson 5.3, pg. 77). My hope for the findings of this project is for students to have a deeper understanding about what habituated practices are, how a writer's physical location affects those practices, and they understand that every student practices their own habituated habits.

328. A Study in the Evolution of Educational Philosophies Across Three Centuries

Submission Type: Poster

Submission Category: Education

Author(s): Laura Curioli

Faculty Mentor: Joel Anderson

Abstract: This project will research a seventeenth-century book that is now housed in the Special Collections Department of the University of Maine's Raymond H. Fogler Library. This text is the ninth edition of the renowned philosopher John Locke's Some thoughts concerning education. The intent of this research is to observe the full history of this text; this will encompass a variety of research angles such as the history of the author, the initial intent behind this text's publication, the socio-political context of the time it was written, and the geographical influence of the period. I will research questions such as: how can we see the influence of Locke's work in our education system currently? What effect did Locke's work have on the educational system of his time? What sort of socio-political intent is within Locke's work and how does that translate to our climate today? This project will serve as a capstone that combines skills and interests emerging from the University of Maine's undergraduate degree programs in History and Secondary Education.

Allied Health

401. The Effect of Simulation on Nursing Student Perceptions of Readiness to Provide End-of-Life Care

Submission Type: Poster

Submission Category: Allied Health

Author(s): Rebecca Dias

Faculty Mentor: Kathryn Robinson

Abstract:

Introduction: Evidence suggests that nursing students in a prelicensure nursing program lack the required preparation to care for patients at end-of-life, causing feelings of inadequacy and stress. New graduate nurses (years 0-5) struggle to address the needs of this patient population leading to considering career changes. Nursing simulation has been shown to enhance competency and is gaining increasing favor in pre-licensure nursing education. Little research has been done on the application of simulation to end-of-life patient scenarios, however.

Design: Utilizing live standardized patients who simulated a home health patient encounter, the nursing student acted as a home health hospice nurse providing assessment and education to the patient and caregiver. Debriefing was conducted after the simulation experience. Watson's Theory of Caring was used to develop and implement the reflective questions.

Methods: Qualitative responses were collected from five undergraduate nursing students. Each student responded to six (6) reflective questions after participation. These responses were de-identified, read for content and themes by multiple reviewers regarding the use of simulation to improve confidence in caring for patients at end-of-life.

Results: Five (5) students chose to participate in this simulation activity and completed the reflective questions. Each of the students, after completing their visit with the standardized patient and caregiver, felt more comfortable having discussions about end-of-life care, treatment options, patient fears, and including caregivers in these discussions.

Conclusion: The use of simulated patient experiences provides an opportunity to bridge the gaps between didactic education and clinical practice in caring for patients at end-of-life.

402. The Impact of International Adoption on the Language Development of Infants and Children in the United States

Submission Type: Poster

Submission Category: Allied Health

Author(s): Krista Butler

Faculty Mentor: Jessica Riccardi

Abstract:
Purpose: The purpose of this review is to examine how English language development is impacted by international adoption.
Methods: This review was conducted using online database searches that extracted and evaluated relevant research regarding the language development of international adoptees. Results: A theme that was prevalent throughout the research was that there is a considerable amount of variability between adopted individuals and their rate of development, highly due to the difference of individual experience pre-adoption. It was found that children adopted early in life go through the stages of development faster than those adopted as toddlers. It is predicted that toddlers will "catch up" to native English speakers. Institutionalization, and how long a child is institutionalized before adoption, is presented to have the most negative impact on how English language is developed post adoption.
Conclusion: Based on the research presented, a causal relationship between international adoption and language delay cannot be determined. However, the research highlights the red flags associated with international adoption that put an adoptee's language development at risk of being negatively impacted. The research available is observational, which limits the external validity of these findings. More research is needed regarding the specific factors noted in this review that negatively impact adoptees, and whether minimizing these factors improves developmental outcomes in international adoptees.

403. A Scoping Review on Cross-linguistic Transfer in Treatment of Bilingual Children with Language Impairments

Submission Type: Poster

Submission Category: Allied Health

Author(s): Calder Levine

Faculty Mentor: Jessica Riccardi

Abstract: Objective: To answer the following research question: What research evidence is available on the generalization of treatment across both spoken languages for bilingual children with language disorders?

Methods: A scoping review was conducted following the 2018 Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRSIMA-ScR) guidelines. Results: A total of 6 peer-reviewed articles were included for review. The types of studies that were included in the review were randomized intervention and quasi-experimental. The studies ranged in participant number, age, and outcome measures. Conclusions: Authors conclude that more research is needed but there is potential for cross-linguistic transfer with regards to universal language concepts.

404. Scoping Review of Interventions to Increase Verbal Utterances for Non-verbal Children with Autism Spectrum Disorder

Submission Type: Poster

Submission Category: Allied Health

Author(s): McKenna Brodeur**,** Anna Williams**,** Lauren Sabatino**,** Naomi Woodson

Faculty Mentor: Jessica Riccardi

Abstract:
Objective: To answer the following research question: What research evidence is available regarding non-home based interventions for eliciting initial verbal utterances for non-verbal children with Autism? Methods: A scoping review was conducted following the 2018 Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRSIMA-ScR) guidelines. Results: A total of nine peer-reviewed articles were included for review. Study designs that were included are non-concurrent multiple baseline (n=3), concurrent multiple baseline (n=1), randomized control trial (n=2), one case study and one single-subject design (n=2). Participants included children aged 3;0-6;4, who were diagnosed with Autism Spectrum Disorder, and had less than 20 words or less to be considered "non-verbal" within our scoping review. Conclusions: There is limited research for nonverbal children between the ages of three and eight with a diagnosis of Autism Spectrum Disorder.

405. Rural Healthcare and Education Access and Utilization after Childhood Brain Injury

Submission Type: Exhibit

Submission Category: Allied Health

Author(s): Samuel Cartwright

Faculty Mentor: Jessica Riccardi

Abstract: The overall purpose of this research project was to understand the accessibility of rehabilitation and educational supports for children with brain injuries from rural communities. Specifically, this project aimed to answer the following research questions for children with a TBI of any severity residing in rural communities: 1) what are the patterns of health care utilization acutely and chronically?; 2) what are the patterns of educational service utilization acutely and chronically?; 3) are parents satisfied with the services their child has received and is currently receiving; and 4) what are the most significant barriers and facilitators to service utilization? This study used data from an online, parent-reported survey to understand service utilization patterns, parent satisfaction, and barriers and facilitators to services for children with TBI in Maine's rural counties. Data collection is ongoing for this project, but data is planned to be analyzed descriptively and statistically using correlations and chi-square tests to examine predictors of higher rates of healthcare and educational service utilization and parent satisfaction. Thematic qualitative analysis will be used to identify barriers and facilitators of rural health services. It is anticipated that children with TBI residing in rural communities will have low rates of healthcare utilization chronically and parents will be generally unsatisfied with services. Transportation, travel distance, availability of providers, and family resources are likely to be identified as barriers to service utilization. The results of this study will provide preliminary information to healthcare and education providers to reduce disparities in outcomes after brain injury for children and families in rural communities.

406. The Effect of Play-based Early Intervention Involving a Speech-Language Pathologist on Social Skills for Children With a Diagnosis of Autism Spectrum Disorder

Submission Type: Poster

Submission Category: Allied Health

Author(s): Paige Kavanaugh, Oladayo Akinyode

Faculty Mentor: Jessica Riccardi

Abstract: Objective: To answer the following research question: What is the research evidence available regarding the effectiveness of play-based early intervention involving a speech-language pathologist on social skills for children with autism spectrum disorder?

Methods: A scoping review was conducted following the 2018 Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRSIMA-ScR) guidelines. A total number of six articles were included for the review.

Results: A total of six peer-reviewed articles were included for review. The types of studies included in the scoping review include a well-designed randomized control trial, single-subject design, multiple baseline analysis, non-randomized control trial, quasi-experimental study, a pretest-posttest design, an observation study without controls, and a concurrent multiple baseline probe design. These studies ranged in levels of evidence from level one to level four. All of the studies had participants between the ages of birth and three years old, and all participants had a suspected or confirmed diagnosis of ASD. The results in all six studies showed that play-based early intervention has a positive impact on children's social skill development. All of the studies reviewed were family-centered early intervention programs.

Conclusions: The results revealed a growing body of evidence of the positive effects of early play-based intervention on the social skills of children 12 months - 36 months with ASD. It was also noted that early play-based intervention is highly family-centered and there is a correlation between the involvement of parents and the effectiveness of treatment. Due to the positive findings, SLP's should do further research, educate themselves and then begin to implement play-based early intervention therapy for children with ASD.

407. The Effectiveness and Benefit of Intentional Hourly Rounding

Submission Type: Poster

Submission Category: Allied Health

Author(s): Patricia Kotyk

Faculty Mentor: Patricia Poirier

Abstract:

Purpose

This presentation will cover the effectiveness and benefits of intentional hourly rounding on patients in a hospital setting. Intentional hourly rounding has been linked to decrease in falls, bell fatigue, and pressure injuries while increasing staff and patient satisfaction.

Method

Education will be provided to the staff on the purpose of international hourly rounding. The five Ps will be explained. A staff survey will be generated in the beginning and end of the allotted time. A tracking sheet will be provided for the nurse to work with the CNAs in creating a smooth, continual rotation for their patients. Survey sheet will also be presented to the secretary to record light/bell requests within allotted time. A survey will be available to record patient satisfaction. All falls will be recorded and compared.

Results-Poster Surveys will be collected and graphed. Evidence based practice will be reported.

Conclusion: The purpose will be to increase compliance and safeguard our patients through hourly rounding. The data will be collected in real time allowing quick responses to issues/concerns. The goal will be accomplished through education and the engagement of nurses in the process

408. The Success of Augmentative and Alternative Communication (AAC) in Adult Patients in Acute Care Settings

Submission Type: Poster

Submission Category: Allied Health

Author(s): Kaitlynn Raye

Faculty Mentor: Jessica Riccardi

Abstract:

Purpose: The purpose of this literature was to evaluate what research evidence is available in regard to the success of augmentative and alternative communication (AAC) in adult patients in critical care.

Methods: In looking at the research available considering adult patient AAC needs in the ICU, broad terms were inputted into databases. Keywords such as “AAC”, “ICU”, “critical care”, and “communication”, were all used in preliminary searches for scholarly articles. The found articles were narrowed down on the basis of patient population and medical relevance.

Results: After an examination of the research, it is evident that there are gaps in the literature regarding AAC in acute care settings. There are several studies on the effectiveness of different AACs, but the breadth of the medical issues found in the ICU make it difficult to consistently identify methods of AAC that have significantly better outcomes than others.

Conclusions: If SLPs are able to research and implement new strategies, there is potential to help other health care providers become better communicators in the acute care setting. Not only would this most likely result in improved health outcomes, but the emotional distress that ICU patients and their families endure would also likely decrease.

409. Stakeholders Perspectives on Cognitive Fatigue

Submission Type: Poster

Submission Category: Allied Health

Author(s): Lydia Bradfield, Brooke Underhill

Faculty Mentor: Jessica Riccardi

Abstract:

Background: After experiencing a traumatic brain injury (TBI), most children experience cognitive fatigue (i.e., mental exhaustion after prolonged cognitive activity). This is known to negatively impact a child's engagement in typical academic and social activities. It is important to understand the perspectives of parents in identifying effective practices for the assessment and management of cognitive fatigue after childhood TBI.

Purpose: The purpose of this study was to understand parents' perspectives, knowledge, and comfort with respect to cognitive fatigue to better understand care patterns and to determine current care practices for cognitive fatigue.

Methods: Twenty parents of children with TBI completed an online survey. Data from the following measures were included in the study's analyses: demographic and injury questions, parental awareness, parental confidence, and impact on child functioning.

Results: A total of twenty parents of children with TBI completed the online survey. Demographic data for the parent and child will be presented on the poster. Overall, parents rated high levels of awareness of cognitive fatigue. Cognitive fatigue was reported to have a negative impact on their child's functioning, with the most negative impacts reported in academic performance/engagement, family engagement, and physical health/functioning. Parents also provided information on factors that worsen and lessen cognitive fatigue and strategies, modifications, and accommodations they and their child use to reduce cognitive fatigue, which will be presented on the poster. This study provides important parental insight into potential ways to reduce the negative impacts of cognitive fatigue for children with TBI.

410. Abstinence-Only versus Comprehensive Sexual Education: Preventing Unintended Pregnancy

Submission Type: Poster

Submission Category: Allied Health

Author(s): Sarah Dorey, Ivalani Callahan, Mckenzie Kelly, Camden Chasse, Hope Smith

Faculty Mentor: Valerie Herbert

Abstract: The subject of what should be taught in our classrooms is hotly debated, especially as it relates to sexual health. The United States has no national requirements for sexual education, leaving individual states and municipalities to decide how they will approach this topic. The two most prevalent curriculums are currently abstinence-only education (AOE) and comprehensive sexual education (CSE). These authors pose the question: in female adolescents aged 10-19 years old, how effective is comprehensive sexual education compared to abstinence-only education in the prevention of unintended pregnancies (UP)? A literature search was conducted on CINAHL, OneSearch, Nursing Reference Center Plus, and Google Scholar using the following search terms: pregnan*, sex*, educat*, abstinen*, adol*, comprehensive. A total of 10 articles met inclusion criteria. There is mixed evidence for the effectiveness of CSE, with only some evidence to suggest it reduces UP. The literature found that AOE was ineffective since many of the adolescents who intended to practice abstinence failed to do so; these adolescents were then less likely to use contraception because they lacked the appropriate knowledge. Limitations of this review include variations in the implementation of CSE across the literature. Based on these findings, there is strong support that integrating a CSE program that fosters comprehensive discussions regarding pregnancy, contraception, and healthy sexual relationships can reduce UP by increasing knowledge and awareness in adolescents.

411. Debriefing: Post-simulation Versus Stop-and-go

Submission Type: Poster

Submission Category: Allied Health

Author(s): Amy Barnes

Faculty Mentor: Patricia Poirier

Abstract:

PICO Question: In Undergraduate nursing students (P), how does post-simulation debriefing (I) compared to stop-and-go debriefing (C), affect learning during the simulation- based experience?
Topic and Purpose:
Simulation-based education provides a valuable learning opportunity for nursing students. It allows for students to practice in a safe environment and then develop, apply and integrate their knowledge into clinical practice and eventually the professional world. Debriefing is a critical element of the simulation process. It allows the student to reflect on their performance and to deepen their understanding of skills, critical thinking, and clinical reasoning. The purpose of debriefing is to give students an opportunity to reflect on their nursing care and rationale for actions during the simulation experience and ultimately strengthen their knowledge and skills. There is potential for missed learning opportunities if debriefing is not facilitated well and in a timely manner.
Method:
An electronic search of the literature was conducted using One Search, CINAHL, Google Scholar, and Medline. The search strategy used the following keywords: debriefing, patient simulation, and undergraduate nursing students. The review was limited to peer-reviewed studies and reviews, published in English, and published after 2000.
Finding:
Despite the importance of debriefing in simulation-based education, there is inconsistency and limited guidelines instructing the best way to facilitate a debriefing. There are also very few studies focused on the timing of debriefing, i.e. post-simulation debriefing to stop-and-go/in-simulation debriefing.
Conclusions:
Different methods, the timing, and the framework of debriefing along with the limited number of research studies with nursing student participants, emphasize the gaps that exist in regards to debriefing in simulation-based education.

412. The Relationship Between Social Cognition and Social Behavior of Young Adults with Autism Spectrum Disorder Using the UCLA PEERS® for Young Adults Social Skill Program

Submission Type: Poster

Submission Category: Allied Health

Author(s): Meaghan Balsdon

Faculty Mentor: Jane Puhlman

Abstract: Research indicates that social communication impairments are a defining and persistent feature of Autism Spectrum Disorder (ASD; CDC, 2022). Social communication consists of social cognition (i.e., knowledge about social rules and situations) and social behavior. It is difficult to gain a comprehensive assessment of social communication because social cognition assessments are prone to inaccuracies due to poor metacognitive skills in individuals with ASD (DeBrabander et al., 2021). Inaccurate reporting of social cognition leads to potential discrepancies in observable social behavior (Vickerstaff et al., 2006). Thus, the relationship between social cognition and observable social behavior is not well understood. This within-subjects research design aims to investigate the relationship between social cognition and social behavior in young adults with ASD and to test the effectiveness of the PEERS® for Young Adults social skill program in improving social cognition and social behavior. Four participants with ASD – Level 1 (ages 18-25 years) completed the Test of Young Adult Social Skill Knowledge and the Contextual Assessment of Social Skills before and after the completion of PEERS® for Young Adults. Results revealed that young adults demonstrated improvement in social skill knowledge but no significant improvement in social behavior after the completion of PEERS® for Young Adults. The improvement in social cognition from pre-intervention to post-intervention was approaching significance. Results also indicated that young adults' introspection of rapport and involvement in social scenarios was inaccurate. Results support the effectiveness of PEERS® for Young Adults in improving participants' social cognition but not in improving their observable social behavior.

413. The Effect of 'PEERS for Young Adults' on Quality of Life and Anxiety for People with Autism Spectrum Disorder - Level 1

Submission Type: Poster

Submission Category: Allied Health

Author(s): Alysha Dagg

Faculty Mentor: Jane Puhlman

Abstract: Social skills deficits as well as comorbid anxiety are two characteristics commonly experienced by people with Autism Spectrum Disorder - Level 1 (ASD-1; American Psychiatric Association, 2013). These characteristics have been identified as contributors to lower quality of lives (Smith et al., 2019). The purpose of the current study was to identify how quality of life and anxiety are affected by social skills intervention, specifically the PEERS® for Young Adults program (Laugeson, 2017). This was the first study to investigate the change in quality of life for people with ASD-1 following social skills intervention.

The current study used a pre-intervention and post-intervention within subject design. The participants ($n=5$) were between the ages of 18 and 28 ($\bar{x}=20$) and were administered the Multidimensional Student Life Satisfaction Scale (MSLSS) and General Anxiety Disorder - 7 Item Scale (GAD-7). The results across all domains (e.g. Family, Work/School, Friends, Home and Self) , measured by the MSLSS, showed that, individually, participants' satisfaction with life increased. As a group, the change in life satisfaction from pre-intervention to post-intervention was insignificant. The results of the GAD-7 indicated a decrease in the individual participants' levels of anxiety. This change in anxiety levels pre-intervention to post-intervention was approaching significance. Despite statistical insignificance, this study serves as an outline for future researchers to further investigate the role PEERS® for Young Adults may have on increasing quality of life and decreasing anxiety.

414. Purposeful Rounding: A Strategy to Reducing Patient Falls

Submission Type: Poster

Submission Category: Allied Health

Author(s): Lori Fiandaca

Faculty Mentor: Patricia Poirier

Abstract:

PICO Question: For hospitalized patients (P) what is the effect of purposeful hourly rounding (I) on incidence of falls (O)?

Topic and Purpose:

Patient falls are a widespread safety problem in healthcare. They account for the leading number of reported adverse events and are often considered the second most common reason for causing harm to patients. The Joint Commission reports, falls with substantial injuries are continually in the top 10 of reported sentinel events. The purpose of this review is to evaluate the literature on purposeful hourly rounding, a nurse led strategy that can lead to a decrease in patient falls in hospitalized patients.

Method:

An electronic search of the literature was performed using CINAHL database. Keywords used included nurs*, hourly rounding, fall prevention, falls with injuries, bedside rounds, interventions, and best practices. Inclusion criteria was limited to peer-reviewed studies in hospital acute care and long-term care setting, nursing strategies for fall prevention, quality improvement initiatives, and systematic and/or meta-analysis reviews. Exclusion criteria included fall prevention strategies in any other clinical setting.

Finding:

Nursing skills, attitudes, and knowledge are important factors to consider in fall prevention strategies. When fall programs are implemented as prescribed and consistently adhered to there have been clinically significant reduction of falls.

Conclusion:

Keeping patients safe from falling is challenging and multifaceted. The ability to sustain fall reeducations has not yet been achieved. However, there are evidence-based strategies that do help reduce falls and falls with injury, such as purposefully hourly rounding.

415. The Effects of Simulation on Student Comfort with Pediatric Patients and Families

Submission Type: Poster

Submission Category: Allied Health

Author(s): Megan Smith

Faculty Mentor: Patricia Poirier

Abstract:

Focus
Pediatric nursing clinical may cause feelings of stress and anxiety in students, which inhibits their ability to learn. These feelings are likely a result of inexperience with children, as well as unfamiliarity with pediatric procedures and a familial aspect to care. Simulation can help guide students through the realities of pediatric nursing by teaching theoretical and clinical skills in a safe environment. This technique minimizes errors and harm to patients while providing an opportunity to improve self-confidence and comfort in performance.

Method
All 23 students enrolled in Nursing Care of Children and Families participated. Two pediatric-based simulations were constructed with focus on pediatric assessment, using distraction techniques to accomplish interventions, and communication to enhance family interaction. Surveys were administered both pre- and post-simulation.

Findings
Pre-simulation, 64% of students said they “neither agree or disagree” regarding understanding how to perform an assessment on an infant and toddler; post-simulation, 82% of students said they “strongly agree” or “agree.” Pre-simulation, 45% of students said they “disagree” in regards to being comfortable performing interventions on infants and toddlers; post-simulation, 73% of students said they “strongly agree” or “agree.” 100% of students said they “strongly agree” or “agree” that this simulation helped to better prepare them to take care of pediatric patients and their families in a medical setting.

Conclusions
Pediatric simulation has been shown to increase student comfort and understanding regarding pediatric care, distraction techniques, and family interaction. This experience should be included at the beginning of each pediatric clinical rotation to improve both patient care and student learning outcomes.

416. Front-end Provider Combating Emergency Department Overcrowding

Submission Type: Poster

Submission Category: Allied Health

Author(s): Carly Haskins

Faculty Mentor: Valerie Herbert

Abstract: Overcrowding in emergency departments is a common and worldwide phenomenon. Overcrowding can be defined as a situation during which the function of an emergency department is compromised primarily due to excessive patient numbers waiting for consultation, diagnostics, treatment, transfer, or discharge, exhausting the present resources. What does the review of the literature highlight about emergency department (ED) patients in the United States who were evaluated by a Front-end-Provider (FEP) compared to patients who were not evaluated in triage on their ED length of stay, the left without being seen rates (LWBS), and patient satisfaction? Specifically, the literature explored a strategy of employing FEP's or Providers-in-triage (PIT) to combat overcrowding in ED's. The literature search included peer reviewed research articles or systematic reviews published within the last 5 years in the United States. The review excluded articles prior to 2018, outside the USA, and lacking peer-review. The review of FEP implementation demonstrated a statistically significant decrease in LWBS rates, decrease length of stay, and increase patient satisfaction. Furthermore, the information derived from the literature review was combined with a case study of a northern New England ED's FEP data compared to LWBS rates to demonstrate an inverse relationship combatting ED overcrowding. FEP programs have tremendous opportunities to improve patient flow, patient satisfaction, staff quality of life, decrease ED overcrowding, and ultimately improving patient safety.

417. Advancing Patient Safety and Experience through a User-Friendly Healthcare Application

Submission Type: Exhibit

Submission Category: Allied Health

Author(s): Samson Cournane

Faculty Mentor: Laura Gurney

Abstract: This research project aims to create a user-friendly healthcare application for users to access essential medical information. The app is designed to enhance the patient experience by enabling users to access vital healthcare information quickly and easily and to build a tailored treatment team to guide them through their healthcare experience. Users of the app obtain information on the qualifications and reviews of healthcare workers as well as pertinent certificates and specializations by using QR code scanning technology. Additionally, an AI-powered symptom checker using GPT-3 would suggest healthcare providers to users based on their reported symptoms. Users can also create a personalized care team for themselves comprised of their healthcare providers. Users can also personalize their app experience according to their preferences within the settings tab. These settings provide options for language preferences, notification preferences, account settings, app preferences, and feedback. The proposed application has the potential to show if the patients are getting qualified healthcare professionals by allowing users to access information on the qualification and reviews of the healthcare workers. The app could increase transparency in the healthcare system and enable patients to make better decisions about their healthcare providers. Ultimately, the research project aims to improve patient safety and enhance the patient experience by developing an innovative and informative healthcare application of advanced technologies to deliver critical healthcare information and individualized healthcare suggestions.

418. Mindfulness-Based Stress Reduction (MBSR) Training Reduces Stress and Enhances Wellbeing in Nursing Students

Submission Type: Poster

Submission Category: Allied Health

Author(s): Maile Sapp, Rebecca Schwartz-Mette, Kelley Strout, Kayla Parsons

Faculty Mentor: Rebecca Schwartz-Mette

Abstract:

Background: A significant nursing shortage exists, with a projected shortage in Maine of 1,450 RNs by 2025 (Northern Light Health, 2022). One contributing factor is burnout, which has been exacerbated by the ongoing COVID-19 pandemic (Office of the Surgeon General, 2022). The aim of this study was to evaluate the effectiveness of an 8-week Mindfulness-Based Stress Reduction (MBSR) intervention on stress, burnout, and wellbeing in nursing students.

Methods: A total of 31 participants participated in the MBSR program, and a control group matched for demographics was identified. All participants ($N = 62$) completed pre- and post-intervention measures. Measures included the Perceived Stress Scale, the Satisfaction with Life Scale, the Oldenburg Burnout Inventory, the Positive and Negative Affect Schedule, and the Five-Factor Mindfulness Questionnaire.

Analysis and Results: A series of analysis of (co)variance (ANCOVA) models tested whether the MBSR group differed from the control group post-intervention. Pre-intervention levels of each variable were controlled in each model. MBSR participants reported significantly lower levels of perceived stress ($F = 63.64$, $p < .001$), higher levels of satisfaction with life ($F = 7.35$, $p < .01$), and greater gains in mindfulness skills ($F = 4.55$, $p < .05$) than did control participants. MBSR participants also reported marginally significantly higher levels of positive affect ($F = 3.49$, $p = .068$). No significant group differences were observed for negative affect or burnout.

Discussion: Findings suggest a generally positive impact of mindfulness training on stress and wellbeing. Implications for nursing education and broad-based wellness interventions are discussed.

419. Investigating the Activity of Bacteria Isolated from Tank Biofilms in a Hatchery System for Sea Scallop, Placopecten magellanicus Larvae

Submission Type: Poster

Submission Category: Allied Health

Author(s): Ayodeji Olaniyi

Faculty Mentor: Sue Ishaq

Abstract: We looked at how the bacteria in tank biofilms in scallop hatcheries might affect the health of the scallops. Our goal is to create a standard set of management practices that improve animal health by putting together good microbiomes and increasing the productivity of farmed scallops and the aquaculture industry.

Biofilm samples were given by DEI, Mook Sea Farm, and Darling Marine Center so that genomics and microbiology tests could be done on them. Scallop tank swabs were taken before cleaning and refilling, and colonies were isolated from TCBS plates to inoculate different mediums and do different tests. Enterobacteriaceae were found using Gram and endospore staining, Triple Sugar Iron Agar, Arginine Glucose Slant, and the Voges-Proskauer test.

There is some evidence that the colony morphology of different Vibrio species can vary depending on the culturing conditions, so we used color as a proxy for sucrose fermentation (yellow colonies) or lack thereof to classify isolates (green).

Compared to static and flow-through tanks, clean tanks have a higher proportion of yellow (51%), and a lower proportion of green (41%), isolates. A total of 53% of the isolates are yellow, while 35% are green; these numbers are similar between static and clean tanks.

When there is more dirt and debris in a tank, the colonies grow faster and there are more yellow isolates. This is true for both static and flow-through tanks. Specifically, there are 55% yellow isolates and 54% green isolates in static and dirty tanks, whereas there are 47% yellow isolates and 47% green isolates in flow-through and dirty tanks.

Additional samples are needed from the three hatcheries over time to help us differentiate between long-term issues and short-term patterns.

420. Assessing Disparities in Access to Advanced Medical Device Therapy in Maine

Submission Type: Exhibit

Submission Category: Allied Health

Author(s): Hannah Longley, Jacob Inger, Killian Hadswell, Asheesh Lanba, Nolan Winston, Matthew Johnson, Amarpreet Kohli, Nihar Kumthekar

Faculty Mentor: Jennifer Crittenden

Abstract: Medical assist devices, such as the Left Ventricle Assist Device (LVAD), are becoming increasingly common for individuals 65 and older. This project aims to identify accessibility disparities in rural and urban areas in Maine in order to influence future expansions of medical device treatments.

The purpose of this project is to design and distribute 10-20 non-invasive mock LVAD called the XVAD. Phase I testing consisted of UMS students <65 years of age. Participants that completed the pre-screening and met qualifying criteria were asked to watch 6 training videos. Following this, participants consented to their participation, received an XVAD by mail or at the USM engineering lab. Participants were expected to wear the device for 5 days, 9am to 9pm. A series of alarms sounded throughout the day, participants responded by pressing buttons in a described sequence. Each alarm and participant response were recorded in a diary booklet. Participants were asked to complete a 44 question post-survey related to demographics, health status, health literacy, usability, and acceptability of the XVAD device.

Phase I recruited nine students, five males and four female participants. Data collected via diary submissions, interviews, and alarm response times have produced several emerging themes: perceptions of the device design for participants with varying abilities, the influence of urgency and anxiety on response times and a request for clarity related to alarm responses and response diaries. These will be influential in revising recruitment, training materials, and device design updates in Phase II testing.

Engineering and Information Sciences

501. Macleod Lib and IDE

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Gunnar Eastman, Matthew Brown, Elijah Story, Jesiah Harris

Faculty Mentor: Torsten Hahmann

Abstract: The field of biology is currently facing a “crisis of reproducibility” according to Jake Emerson, one of our clients and an engineer at Jackson Laboratory in Bar Harbor, Maine. The development of ontologies is paramount to overcome this crisis of reproducibility by helping to document the semantics of scientific data. Common Logic is a standardized computer-interpretable language with the Common Logic Interchange Format (CLIF) as one syntactic way of specifying ontologies. Macleod (Macleod - A Common Logic Environment for Ontology Development) is a tool developed by Dr. Hahmann to parse CLIF files to ensure they are syntactically correct according to the CLIF standard. As such, the CLIF parser is central to an IDE for supporting the development of CLIF ontologies.

In this project, the team has focused on (1) making Macleod more broadly available as a standalone python library available via the widely used PyPI platform, on (2) developing a plugin for the Spyder IDE to make it easier to find and correct syntax errors in CLIF ontologies, and (3) on extending the parser's functionality to cover a greater share of the CLIF standard.

502. Structural Testing of Micropile Threaded Joints

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Sebastian Montoya-Vargas, William G. Davids

Faculty Mentor: Aaron Gallant

Abstract: Permanent steel casing micropiles are an advantageous foundation system that can provide high geotechnical capacities in tension and compression. However, when lateral and flexural loads are imposed, these micropiles display a limited capacity due to early bending failure of the steel casing threaded connection that couple the casing segments. The proposed research project aims to develop an analytical model capable of predicting the joint bending strength and failure mode of micropile threaded connections based on its geometric and material properties while considering the presence of center reinforcement and combined axial and bending loads. The model will combine displacement fields characteristic of the flexural failure with principles of compatibility and equilibrium to determine the cross-sectional stress distribution at the threaded joint, and thus, allowing to calculate the bending moment corresponding to failure. The project will include four-point bending tests on micropile specimens with different geometric details to characterize the longitudinal (axial) and radial displacements at the box-end of the connection that will serve as input for the analytical model. The specimens will be loaded in pure bending or bending combined with axial compression until failure of the threaded joint occurs while the displacements produced by the flexural load are monitored using digital image correlation (DIC). The collected data will be extended using finite element analysis (FEA) to characterize the features that are not observable through DIC, and later used to improve the physical consistency of the analytical model.

The outcomes of this project will allow practitioners to reliably determine the flexural strength of the connection and aid decisions regarding the details and milling of threaded connections and selection of appropriate center-bar reinforcement. Also, by providing the industry with a predictive model, financial, physical, and logistical efforts related to structural testing will be saved.

503. Food Rescue MAINE Waste Watcher: Reducing Food Waste in the State of Maine

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Levi Sturtevant, Declan Brinn, Chase Pisone, Finn Jacobs, Gavin Palazzo

Faculty Mentor: Susanne Lee

Abstract: As a part of our Computer Science Capstone, our group is developing an application for Susanne Lee, Faculty Fellow at the Sen. George J. Mitchell Center for Sustainability Solutions. The goal of this app is to provide a user-friendly and rewarding experience that will encourage more consumers to track and measure their food waste as a “gateway” to food waste reduction. We've dubbed this app "Waste Watcher" under the Mitchell Center’s “Food Rescue MAINE” food waste solutions brand.

Waste Watcher has been designed to appeal to a broad audience in order to promote statewide usage and change consumer food waste habits. Additionally, food waste data has suffered from inconsistency and a large amount of estimation. The extrapolation of this data is not concrete enough to present in documentation. Our application is designed to address both problems by changing bad food waste habits and providing large sets of reliable data for the Mitchell Center.

Our abstract will focus on the process our group has taken to develop this application starting from the initial meetings, documentation, proof-of-concept, an in-progress version of the app, and likely a fully functioning prototype on display.

A large portion of the Computer Science Capstone involves expanding on a previous team’s project, however that was not the case for Waste Watcher. We were the first team to see this project, and we have designed it to be built upon in the future. Whoever receives this project next year will have the opportunity to add app features that we won't be able to build due to time constraints. Our product goal is to provide an exceptionally designed, built, and maintained piece of software that can be updated over time with new features to fuel its continued growth.

504. Automation of Prehospital Tourniquet Use for Improved Safety and Accessibility

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): Anna Briley, Christopher Roberts, Gabrielle Begos, Evan Leonard

Faculty Mentor: David Neivandt

Abstract: Uncontrolled bleeding is the leading cause of death in trauma patients, both civilian and military. These hemorrhages often occur at extremities such as the arm or leg, accounting for 60% of preventable deaths on the battlefield. Tourniquets are life-saving devices that can prevent fatal blood loss from limb injuries. By compressing arteries above the site of bleeding, tourniquets stall hypovolemic shock until the patient reaches professional medical care. The use of existing tourniquets in prehospital settings is associated with risks, such as nerve damage from excessive compression and harmful metabolites that can lead to amputation. Furthermore, treatment depends on information that is sometimes unavailable, such as duration of tourniquet application and overall physiological status of the patient. Thus, there is a need for tourniquets that minimize risks of tissue damage and improve communication of important patient information. We seek to engineer a smart tourniquet with automatic feedback that continually self-adjusts the amount of pressure applied based on the patient's blood pressure. Measurements from photo sensors and pressure sensors wired to Raspberry Pi Picos will control the inflation of a blood pressure cuff and digitally output heart rate. Meanwhile, a screen attached to the cuff will display pertinent information such as time since application and vitals. The functionality and safety of these components will then be tested for validation. Automation will mitigate user error, keep medical personnel informed, and improve patient safety. Together, these effects have the potential to reduce amputation and mortality in trauma patients.

505. User Friendly Front-End Database Interaction for TTRPG Creature Creation

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): David DiFrumolo, Matthew Virgin, Tristan Zippert, Cedric Fahey, Landon Thibodeau

Faculty Mentor: Terry Yoo

Abstract: Moonwake Development's project involved creating a front-end user-friendly application for Frog God Games, a tabletop role playing game publishing company, utilizing their existing Oracle database. The objective of the project was to design an efficient and easy-to-use interface that would allow the user to interact with the database and search for and create their own role playing game monsters that they can use in their next adventure. Our application was designed to provide users with an intuitive and visually appealing interface, making it easier to navigate through the database.

To develop the application, we used Oracle as the backend database and designed the front-end using React, a popular JavaScript library. The interface was designed to be responsive, so it would be accessible across multiple devices, with the creature search and creation existing on FGG's website. We also integrated several user-friendly features into the application, such as a search bar and filters, which will enable users to find and access information more easily.

The application developed for the FGG company database can have a general use in any organization that requires a user-friendly and efficient system to interact with large amounts of data. This tool can be implemented in various industries such as healthcare, finance, and retail, where it is essential to access and manage large amounts of data. With the ability to customize the tool to meet specific business requirements, organizations can utilize this application to improve their database management, reduce time spent on data retrieval, and improve overall productivity.

506. Durability of Large-scale 3D Printed Materials for Transportation Infrastructure

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Felipe Saavedra Rosa, Sunil Bhandari, Roberto Lopez-Anido

Faculty Mentor: Roberto Lopez-Anido

Abstract: Large-format extrusion-based polymer Additive Manufacturing (AM) or 3D printing has been used recently for civil infrastructure applications, including culvert outlet diffusers and precast concrete formwork. This research assesses thermoplastic composite materials' durability and dimensional stability under different environmental exposure conditions. Accelerated exposure in the laboratory was conducted for moisture absorption, freeze-thaw cycles, and ultraviolet radiation weathering. Specifically, this research investigates the effect of accelerated laboratory durability tests on the mechanical behavior of 3D-printed composite materials.
The research examines the performance of two bio-based renewable composite materials, Wood Fiber/ Polylactic Acid (WF/PLA), Wood Fiber/Amorphous Polylactic Acid (WF/aPLA), and one synthetic composite material, Carbon Fiber/ Acrylonitrile Butadiene Styrene (CF/ABS). The material durability is evaluated using visual and quantitative surface analysis methods, dimensional stability, and property retention of mechanical behavior after accelerated exposure. The surface analysis methods implemented are contacted angle measurement and surface roughness measurement. The representative mechanical properties investigated are flexural strength and flexural modulus.

507. Sensor-Based Aviation Headset for Pilot Safety

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): Emily Hanscom, Maher Alsamsam, Anna Johnson, Jake Loranger

Faculty Mentor: Robert Bowie

Abstract: Aviation is a critical form of transportation that can become deadly with mechanical failures or medical emergencies. Currently, there is a lack of products that record pilot health and safety in real-time, hindering the ability to reduce and identify aviation accidents. The purpose of this work is to obtain, analyze, and convey vital biometric information from non-commercial pilots, thus improving communication to provide preventative and diagnostic measures for emergencies. To accomplish this, an application and device attached to an aviation headset were designed to monitor both pilot health and cabin environment using sensors. These sensors collect and store data pertaining to body temperature, cabin temperature, pilot breathing rate, and air quality. Each showed adequate performance through calibration and testing. Accelerometers were also implemented to evaluate simulated in-flight scenarios, including turbulence and head-slumping. To enhance communication, this device connects through Bluetooth to an iOS application the team built and conveys live statistics and graphs to the pilot. The device also interfaces with an Apple Watch, allowing for visual and haptic feedback to the pilot, as well as incorporating additional biometric information such as heart rate, SpO2, and actigraphy. Future work will involve further accelerometer testing, limitation testing, and integration of other sensors to improve diagnostic capabilities. Nevertheless, results demonstrate this device will help increase identification of emergencies and subsequent communication for preventative and diagnostic aviation measures, both in real-time and through recorded data for later use.

508. Ultra-Low-Cost, Remote, and Continuous Water Quality Detection System

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Liza White

Faculty Mentor: Caitlin Howell

Abstract: Water treatment systems need regular testing to ensure they operate effectively and efficiently to maintain critical operational parameters. Traditional testing methods involve manual collection and analysis in a dedicated laboratory which can be time-consuming and expensive. These limitations can also lead to infrequent testing, resulting in missed opportunities to address potential issues promptly. Through leveraging the Maine paper industry technology and machine learning, we looked to develop a continuous, cost-effective detection system of incoming wastewater streams. Our mass-manufactured and affordable approach uses a nanostructure pattern that functions as a diffraction grating, breaking up incoming light into its component wavelengths. As those wavelengths pass through a water sample of interest, they are absorbed or transmitted in a way unique to the components' makeup. One key advantage of our approach is its ability to be equipped with a machine learning algorithm, which can continuously monitor the diffraction pattern and alert remote users when deviations beyond defined tolerance levels are detected. Developing a low-cost, continuous detection system for wastewater streams will allow water quality testing to be made more accessible and permit treatment plant operators to adjust quickly and effectively to ensure optimal plant operation.

509. Using Alkaline Electrolysis to Explore the Efficiency of Household Electrolytes

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): Daniel Adam

Faculty Mentor: David Dvorak

Abstract: Hydrogen is a cornerstone of renewable energy for its combustibility when exposed to oxygen and heat. Electrolysis, the chemical process of using electricity to separate hydrogen and oxygen atoms in water, has different forms and processes for collecting hydrogen for energy purposes. Alkaline Electrolysis uses conducting plates and runs a current directly through water mixed with an electrolyte. It's the longest-proven process, as it has been deployed on a large scale since 1927, and has lower investment costs. This approach has a lower initial cost than other electrolysis methods, which is ideal for an experiment. The disadvantage to this approach is that this process is vulnerable to the presence of impurities. Using distilled water in a closed environment can prevent these impurities from accumulating. This project uses the Alkaline Electrolysis process to explore the efficiency of different household electrolytes; baking soda, lemon juice, and Gatorade. Electrolytes are substances that aid in conducting electric current by the movement of ions, usually a base or acid. The testing process is composed of three processes: building, testing, and data processing. The construction phase was used to design and assemble the electrolyzer that will be used for data collection. After assembling all the components, a brief test was conducted to ensure there is a measurable output before moving to the next milestone. Testing the electrolyzer is done by measuring the current of the fully charged plates as it passes through the water-electrolyte solution. Using an equation to calculate hydrogen output once the solution is steady and the plates are fully charged, the final electrolyte and its optimal concentration can be determined and plotted. This project aims to optimize the electrolysis by looking for any correlation between different electrolytes and by seeing if too much of a concentration of an electrolyte can in fact harm the electrolysis process.

510. Redesign and Optimization of an Enteral Drainage Bag for Patients with Gastroparesis

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): Meghan Boos, Abby Houghton, Julia Ross, Molly Olzinski

Faculty Mentor: Robert Bowie

Abstract: Patients with non-functional gastrointestinal tracts requiring a gastrostomy tube (G-tube) for enteral drainage were left without an alternative when a leading manufacturer ceased production of their single-use drainage bag. Consequently, the purpose of the current capstone project was to redesign and optimize an enteral drainage bag system to be reusable, have a lifespan of three weeks, and improve previous drainage bags while prioritizing patient safety and comfort. To achieve these objectives, the redesigned drainage bag employed poly(tetrafluoroethylene) (PTFE) film, an acid-resistant material, and optimized the PTFE thickness for durability and flexibility. Experiments were performed to determine the minimum thickness that provided effective acid resistance and maximum flexibility. Specifically, the PTFE films were exposed to 0.2M hydrochloric acid (HCl) which replicated stomach acid and was monitored for structural integrity. Additional critical system components including drainage tubing, filter housing, and epoxy used to seal the bag were tested against 0.2M HCl. A 0.015" thick PTFE film and other bag components were found to be sufficiently acid resistant. To increase the usable lifespan of the bag and maximize patient safety, a neutralizing agent was added. The neutralizing agent raised the pH of the bag contents to 7 (neutral) which reduced the risk of acid burns should an unintended leak occur, and negated chemical attack on the PTFE film. The capstone design team has successfully created a prototype of a functional enteral drainage bag that meets the project objectives of being amenable to mass production while providing a safer patient experience.

511. Safety and Comfort Improvement System for a Rescue Sled

Submission Type: Exhibit

Submission Category: Engineering & Information Sciences

Author(s): Zoe Vittum, Arihant Tallapureddy, Blake Turner, Cameron Andrews, Karissa Tilbury

Faculty Mentor: Robert Bowie

Abstract: Snowmobiling is a beloved pastime that heavily contributes to the northeast economy. However, with the increasing power and capability of new snowmobiles, the prevalence of snowmobile accidents continuously increases. Most of these accidents are in remote locations where the only accessible mode of transportation is via snowmobile. When serious accidents occur, rescue sleds and emergency medical technicians (EMTs) are deployed to safely extricate and stabilize patients. Current rescue sled solutions inadequately protect patients and EMTs from wind, debris, and ground impacts causing discomfort and further injury to the patient. To combat these limitations a polycarbonate shield was designed to reduce the wind and debris reaching the patient and EMT. An in-sled suspension system was designed to support the patient on a backboard and absorb impacts during transportation. Finally, a heat retention system was designed to generate an insulating and heat-reflective vapor barrier. COMSOL and Simulink models were developed to test the theoretical efficacy of the modified hood and suspension systems, respectively. The COMSOL model displayed a 6.25x reduction in air velocity surrounding the EMT and patient with the modified hood compared to the original. The Simulink model found a maximum return to baseline time of 4.7 seconds of the patient and backboard at maximum speed and patient weight. The simulated results and heat retention system will be verified on the physical model once constructed. Together the safety improvement systems implemented effectively facilitate passive rewarming while reducing the impact of transportation and environmental hazards on the patient and EMT.

512. Building the Trip Builder, Developing a Trip Planning System for Snowmobilers in Maine

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Avery Gosselin, Peter Martin, Chris Chappelle, Connor Lariviere, Orion Schwab

Faculty Mentor: Terry Yoo

Abstract: We, the SledDogs Development Team are collaborating with Maine-based snowmobiling startup SledTRX to develop new functionality for their snowmobile mapping service titled the "Trip Builder". This system enables riders to plan their trips in advance, finding trails and services like gas stations and lodging, empowering them to explore Maine's over 14,000 miles of groomed trails. Our team, composed of five students enrolled in the University of Maine's Computer Science Capstone course, began developing this system in October of 2022 and has employed an agile development framework throughout the past several months of work. Through this process, we have interfaced with SledTRX to outline requirements for the implementation of the system as well as produce documentation defining its architecture and proposing designs for its user interfaces. In the spring semester, we began implementing this product using React, a Javascript library for web development. We have written, tested, and implemented code, and as we continue through this semester we will introduce comprehensive testing methodologies, perform integration tests, and, ultimately, whole system tests to ensure fulfillment of our requirements. We will also develop documentation to assist system administrators (our clients at SledTRX) with maintaining the system into the future. Finally, we will also create guides so that future users may quickly get started using this tool and enjoy Maine's wilderness and local businesses.

513. Predicting the Material Property of a 3D Print: Thermal Data Analysis

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Aayush Manandhar

Faculty Mentor: Greg Studer

Abstract: Fused deposition modeling is the most popular way of additive manufacturing, where materials are extruded through the 3D printer nozzle to build 3D objects. Many factors affect the material properties (tension, compression, and bending) of a 3-D printed object, including the print speed, print temperature, layer thickness, print orientation, and the material used to print the 3D object. Precisely analyzing the extrusion temperature and the cooling rate of the extruded material is essential to improve and optimize the printing process and predict the mechanical performance of the 3-D printed object. A point cloud is a set of data points in space that represents a 3D shape. This paper explores a novel method of recording point cloud data that stores the thermal information of the entire 3-D printing process. Multiple clusters from the gathered thermal point cloud data are generated using unsupervised machine learning techniques and later analyzed to predict the material property of the 3D print. Clusters in the 3-D printed object with higher average print temperature are expected to show good inter-layer adhesion but also have a higher probability of structural deformation due to high viscosity.

514. Lignin Fractionation

Submission Type: Poster

Submission Category: Engineering & Information Sciences

Author(s): Gloria Agyapong, Sampath Gunukula, M. Clayton Wheeler

Faculty Mentor: Sampath Gunukula

Abstract: Lignin is the second most abundant biopolymer in nature. The lignin content in softwoods is about 15 to 30 wt.%, and in hardwoods, it is about 20%. The lignin is currently underutilized because of a high heterogeneity of its structure. To utilize the great potential of this material fully, there is a need to develop an effective method that is economically and environmentally sustainable for producing lignin fractions with a more homogenous structure. In this study, novel deep eutectic solvent systems with a lower viscosity will be developed, and the effectiveness of these novel solvent systems for fractionating lignin will be studied. The novel deep eutectic solvents will be characterized by measuring the activity coefficients and melting point depression. These solvents will be further characterized using the FT-IR technique. Both Organosolv and native lignin will be fractionated using the novel deep eutectic solvents in two or more fractionation process steps. The collected lignin fractions as well as the Organosolv/native lignin will be characterized using the NMR technique. These characterizations will enable to understand the relationship between the solvent polarity of deep eutectic solvent system and the chemical structure of resulting lignin fractions.

515. Dynamic Strain Sensing In A Harsh-Environment Using A Surface Acoustic Wave Resonator (SAWR) Sensor

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Shane Winters

Faculty Mentor: Mauricio Pereira da Cunha

Abstract: Dynamic strain sensing is necessary for structural health monitoring, condition-based maintenance, maintaining operation efficiency, and ensuring worker safety in high temperature (HT) harsh-environments (HE) such as aerospace, automotive, powerplant, and advanced manufacturing. Sensing in these environments presents significant difficulties for sensor implementation and measurement, including sensor integrity, stability, temperature cross-sensitivity, HT attachment, and sensor packaging. Surface acoustic wave resonator (SAWR) sensors can respond to these needs, are small, and can be wirelessly interrogated. In this work, a SAWR sensor was mounted on an exhaust duct at the University of Maine (UMaine) Steam Plant. The UMaine Steam Plant is an excellent testbed for HT HE sensors, since it contains several HT HE locations including boilers, fuel combustion chambers, steam pipes, and exhaust ducts. Exhaust ducts are of particular interest as dynamic strain signals present in exhaust gases can be indicative of upstream safety and maintenance issues present in the boiler and/or the fuel combustion chamber. As the power generation equipment at the UMaine Steam Plant is well-maintained and free of issues at the time these measurements were taken, artificial dynamic strain signals were induced in the exhaust duct using alternate mechanical instruments. The SAWR sensor successfully detected dynamic strain signals at frequencies of 123Hz and 48Hz, which were the respective major frequency components of each of the external mechanical strain inducers, indicating that the SAWR sensor is capable of successfully measuring dynamic strain signals in the exhaust duct of a power plant environment.

516. Feasibility of Thermoplastic Extrusion Welding as a Joining Method for Vacuum-Assisted Additively Manufactured Tooling

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Chase Flaherty

Faculty Mentor: Wilhelm Friess

Abstract: In recent years, additive manufacturing (AM) has been successfully utilized for the production of large-scale composite tooling. Within these endeavors, however, limited research has focused on joining methods between printed sections. This work evaluates the feasibility of thermoplastic extrusion welding as a joining method for additively manufactured tooling structures. This joining method was assessed based on industry specifications of conventional thermoset tooling for wind blade manufacturing utilizing the vacuum-assisted resin transfer molding (VARTM) process. The specifications include requirements for the mechanical strength, vacuum integrity, roughness, and hardness of the tool surface. The feasibility of this welded polymer joint was demonstrated through subscale testing of 1” thick, welded, AM high-impact polystyrene (HIPS) plates. It was found that thermoplastic extrusion welds within AM components can maintain vacuum integrity at 20℃ without a surface coating and with proper surface preparation. This met the vacuum leakage specification of 10 millibar per 30 minutes. Although beyond the specification, the vacuum leakage was also tested at an infusion temperature of 80℃. The surface finish was compared with hardness and roughness testing of the welded and machined AM surfaces, showing a decrease in hardness and roughness in the surface of the weld at both temperatures. Standardized ASTM mechanical testing of welded specimens showed tensile strengths of 30% to 50% of the base HIPS material and a similar flexural strength. With the addition of undersurface reinforcement within the mold and a surface coating, extrusion welding shows promise for joining large-scale AM tool sections in a manufacturing environment.

517. Developing an Interface for Meaningful Photo Sharing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Avery Gosselin

Faculty Mentor: Sabrina DeTurk

Abstract: In this project, I propose the development of an application that celebrates diverse perspectives through photo sharing within an interactive mobile interface. This will take the form of a participatory digital art project, where members of the public may capture and submit photos that (in their eyes) represent a predefined theme (potential themes could be growing up, life, nature, etc.). These photos will then be aggregated into a mosaic of all other user-submitted photos relating to that theme. The goal will be to celebrate the similarities and differences we share in how all participants perceived the theme and attempted to capture it in their photos. I will also ask users to complete a short survey when submitting an image where they will provide non-identifying information such as age range, gender identity, ethnicity, country of origin, and potentially more. Connecting this data to their photo submission will enable filtering options within the mosaic interface, where users may curate the page themselves, and further explore how these data points may influence the photographer's perception of the theme and their artistic decision-making. I will be building this interface myself utilizing React Native, a popular framework for developing cross-platform mobile applications. The ultimate goal of this project will be the creation of the application and collection of a small initial dataset to serve as a proof of concept for later work.

518. CO Oxidation Assessment of a New Commercial Catalyst for NASA Environmental Control and Life Support Safety Applications

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Madison McCarthy, Sudheera Yaparatne

Faculty Mentor: Onur Apul

Abstract: Growth of research in outer space calls for continued evaluation of spacecraft safety systems. NASA currently uses a catalyst developed by TDA Research, Inc in the contingency breathing apparatus and Orion smoke eater filter to eliminate carbon monoxide (CO) released during fire events in the Orion Multi-Purpose Crew Vehicle (MPCV). The release of Astrea Materials, a commercial gold-titania catalyst comparable to TDA, prompted NASA to investigate the optimal material for CO removal in the MPCV. In this study, the Astrea catalyst was evaluated by measuring CO removal efficacy. Experiments involved 1000 ppm of CO being flowed with zero air through a fixed-bed reactor. Experimental variables were gas hourly space velocity (GHSV), relative humidity (RH), and catalyst temperature (T). CO removal exceeded 97% at 2.7×104 h-1, regardless of T. Catalyst efficiency significantly decreased at higher GHSVs, 1.1×105 h-1 and 1.6×105 h-1, with CO removal approaching 50% due to lower catalyst contact time. Reaction kinetics confirmed an Arrhenius relationship: raising T increased CO removal. For GHSVs above 2.7×104 h-1, increasing T from 0 to 25 °C increased CO removal by over 25%. RH significantly decreased catalyst performance at higher GHSVs, 1.1×105 h-1, with a drop from 79.7% removal at 15% RH to 66.4% at 85% RH. Astrea performs well at low GHSVs and 0% RH and activity was reduced outside those conditions. Identical experiments will be repeated with TDA to compare catalyst efficiency and resilience. The poster will discuss catalytic capabilities of TDA and Astrea in CO removal for the MPCV.

519. Areas of Same Cardinal Direction

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Thunendran Periyandy

Faculty Mentor: Max J. Egenhofer

Abstract: Cardinal directions, such as North, East, and Northeast, are the foundation for qualitative spatial reasoning, a common field of GIS, Artificial Intelligence, and cognitive science. While they are important search criteria in spatial databases, such cardinal directions capture the relative spatial direction relation between a reference object and a target object. The projection-based model for such direction relations has been well investigated for point-like objects, which are approximations of extended objects, such as lines and regions, yielding a relation algebra with strong inference power. The Direction Relation Matrix defines the simple region-to-region direction relations while approximating the reference object to a minimum bounding rectangle. Models that capture the direction between extended objects, fall short when the two objects are close to each other. For instance, the forty-eight contiguous states of the US are typically considered to be South of Canada, yet they include regions that are to the North of some parts of Canada. This research considers the cardinal direction as a field that is distributed through space and may take on varying values depending on the location within a reference object. Therefore, the fundamental unit of space, the point, is used as a reference to form a point-based cardinal direction model. The model applies to capture the direction relation between point-to-region and region-to-region. As such, the reference object is portioned into areas of same cardinal direction with respect to the target object. The work proves there is a set of 106 cardinal point-to-region relations, which can be normalized by considering mirroring and 90° rotations, to a subset of 22 relations. The significance of the model is that a set of base relations defines the direction relation anywhere in the field, and the conceptual neighborhood graph of the base relations offers the opportunity to exploit the strong inference of point-based direction reasoning for extended objects.

520. Cluster Computing with the BeagleBone Black

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Dyllon Dunton

Faculty Mentor: Vincent Weaver

Abstract: Modern day supercomputers are conventionally composed of many worker-computers called "nodes", controlled by a single master-computer node. This relationship is called "cluster computing". For many years the typical choice of computer for low-end clusters has been the Raspberry Pi, an "embedded board", due to its quick processing speed and affordable price. However, its recent inflation in price has made this embedded board less reasonable for the everyday enthusiast. In addition, this problem is scaled much more for a cluster computer since many embedded boards are needed. A worthy alternative is the Beaglebone Black (BBB), since it is much less expensive and boasts similar capabilities. Since the vast majority of data involving cluster computing revolves around the Raspberry Pi, the relationship between the quantity of BBB microcomputers to the cluster's overall processing speed is not clear. This research aims to explore the capability of the BBB in the world of cluster computing in comparison to the Raspberry Pi. Specifically, three factors will be analyzed for the two embedded boards. Firstly, the processing speed achieved using up to eight nodes will be recorded for each candidate. Second, the power consumption for each candidate will be calculated for the same number of nodes, since a quicker computer may not be worth the cost if it requires significantly more power. Third, the cost of each candidate will be factored into the data to determine the processing speed in comparison to its cost. This will allow for a direct comparison between the value of the two candidate embedded boards.

521. CNF-HA Composite for Osseo-integration and Bone Regeneration

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Adeola Fadahunsi, Karissa Tilbury

Faculty Mentor: Michael Mason

Abstract: Bone defects caused by fractures and disease are a major global concern, as structural integrity of the skeletal system and individual bones deteriorates with age. This is because bone tissue renewal cannot compensate for its disintegration over time. This condition impacts bone porosity, brittleness, and bone strength, thus increasing susceptibility to fractures. Nonetheless, there is an increasing estimate for the prevalence of bone deformities in the human population, and treating bone defects remains a difficulty in medicine. While bone grafts are the most extensively used therapy for bone abnormalities, there are complications connected with their clinical use. Researchers have consistently worked to present alternatives to these procedures by building scaffolds that can imitate the form, properties, and function of human bone, allowing viability, proliferation, conduction, osteo-integration, and regeneration of bone osteoblasts within these materials. Our work attempts to engineer bio-mimetic bone scaffold from naturally ubiquitous and available cellulose nanofibrils (CNF) in a composite with hydroxyapatite (the main mineral component in bones) and collagen, then investigate the scaffold biocompatibility and interaction with bone osteoblasts. This project first considers the mechanical properties of the CNF scaffold; then evaluates cell viability, proliferation, differentiation, and osteoblast orientation on the scaffold; and concludes with evaluating biodegradation as a function of time within the extra-cellular matrix (ECM) in vitro.

522. Using Deep Learning for Artificial Intelligence Pathology

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Josh Hamilton, Jeremy Juybari, Yifeng Zhu

Faculty Mentor: Andre Khalil

Abstract: In lower income countries there is a massive demand for pathologists, currently 2/3rds of pathologists are located in only 10 countries. To alleviate this lack of pathologists and dichotomy in standards of care worldwide there is a need for more automated pathology platforms. The recent explosion of artificial intelligence with language transformer models like chatGPT, can also be applied to automated digital pathology using visual transformer architectures. Our work involves using a two model approach to calculate tumor cellularity in both pancreatic and colon cancer patient H&E slides. This metric is the percentage of tumor cells currently found in the H&E tissue slice and is calculated by pathologists to determine a patient's response to therapy. One model uses a StarDist architecture to segments cells from the tissue, and a second visual transformer model classifies these segmented cells as tumor or not. These results are then fed to an algorithm which calculates the tumor cellularity and generates a cell mask coloring cells that are tumor or not in the image. This approach achieved a score of 0.77 interclass correlation score across the 53-slide training dataset and was submitted to the PAIP 2023 grand challenge.

523. Ultra-Stretchable Conductive Polymer Complex as Strain Sensor with Excellent Linearity and Repeatable Autonomous Self-Healing Ability

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Arya Ajeev, Colton Duprey, Behrokh Shams

Faculty Mentor: Evan K Wujcik

Abstract: Wearable strain sensors are essential for the realization of applications in the broad fields of bio sensing, soft robotics, and immersive gaming, among many others. These flexible sensors can be safely and comfortably adhered to the skin and capable of monitoring human motions with high accuracy, as well as exhibiting excellent durability. However, it is challenging to develop electronic materials that possess the properties of skin, compliant, elastic, stretchable, and self-healable. This work demonstrates a new regenerative polymer complex composed of poly(2-acrylamido-2-methyl-1-propanesulfonic acid), polyaniline, and phytic acid as a skin-like electronic material. It exhibits ultrahigh stretchability (1935%), repeatable autonomous self-healing ability (repeating healing efficiency >98%), quadratic response to strain (R2 > 0.9998), and linear response to flexion bending (R2 > 0.9994), outperforming current reported wearable strain sensors. However more importantly, the sensor is produced using significantly more eco-friendly materials than many other sensors currently produced. It is also recyclable, as it is self-healing and infinitely recastable, allowing for one synthesis to produce a long-lasting sensor.

524. How Layer Alignment in Deep Neural Network Discriminates Attack Types in Adversarial Learning

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Rhiannon Gould

Faculty Mentor: Salimeh Yasaei Sekeh

Abstract: Humans can look at a photo and classify particular features from their surroundings such as a cloud, building or a tree. While this ability is second nature to humans, a deep learning (DL) semantic segmentation model is vulnerable to noises and perceptron perturbations called adversarial examples. Therefore, DL-based techniques need to either train or defend such examples to counteract their effects on learning tasks. Traditional approaches to adversarial robustness focus on training or retraining a single network on attacked data, however, in many real-world problems, the task is learned in the presence of multiple attacks; these approaches decrease the performance compared to networks trained individually on each attack. We mitigate confusion that DL models experience by first discriminating the input data based on type of attack and then classifying the data in their similar-attack groups. The discriminator network uses a deep neural network to separate data into their specific attack-expert ensemble network with the flexibility in similar type attacks. Our approach allows for the presence of multiple attacks mixed together while also identifying attack types during testing. We leverage alignment measures to monitor the effects of different attacks on the layers of the discriminator and then apply this information into our discriminator loss function. By this way, we utilize the learning process of the discriminator in identifying the attack types. We validate our method by testing with benchmarks and datasets such as Resnet-CIFAR10 and VGG-CIFAR100, and show that our method outperforms existing baselines.

525. Adversarially Robust Subgraph Learning via Layer-based Attention Approach

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Sepideh Neshatfar, Mahsa Mozafarinia

Faculty Mentor: Salimeh Yasaei Sekeh

Abstract: Graph Neural Networks (GNNs) are powerful tools for analyzing and processing structured data, particularly in real-world applications including biology and medical sciences. GNNs leverage the information from nodes in the neighborhoods of the graph and use message passing to extract updates. This technique allows GNNs to model complex dependencies between nodes and edges. However, the performance of GNNs can be severely impacted by noisy nodes and adversarially attacked graphs. In such attacks, an adversary aims to alter the input graph in a way that misleads GNN's node classification predictions.

To address this issue, we propose a novel method, Layer-Attention-based Extraction of Adversarially Robust Subgraph (LA-EARS), that leverages the mid-stage training and identifies susceptible nodes to adversarial attacks. Our method removes the susceptible nodes from the graph and protects sensitive ones under adversarial and vanilla input conditions. We define a sensitivity score that measures the impact of the nodes on the classification training in the presence of attacks. Using these scores, LA-EARS identifies and masks out the most vulnerable/susceptible nodes, forming an adversarially robust subgraph.

The goal of the LA-EARS method is to create an adversarially robust subgraph that can mitigate the impact of learning in layers in the mid-training stage and improve the overall performance of GNNs. By comparing the performance of the original network and the subgraph when subjected to the same attack, the effectiveness of the resulting subgraph can be evaluated in achieving robustness. We will experimentally evaluate this on common citation graph datasets like Cora and CiteSeer.

526. Technologically Enhanced Stokes Basket

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Justin Williford, Luke Berger, Marina Mohawass, Theophile Nkulikiyinka

Faculty Mentor: Robert Bowie

Abstract: The use of Stokes baskets is essential in search-and-rescue (SAR) operations for transporting patients across rugged terrain to awaiting emergency vehicles. However, current baskets lack the ability to provide continuous vital monitoring and communication capabilities during patient transport, leading to potential complications in patient care. Additionally, SAR options are often carried out in harsh and remote environments where the rescue team is exposed to potential injuries. Thus, there is a need for technological additions to current Stokes baskets. The current project is to enhance SAR Stokes baskets by designing and developing a vitals monitoring attachment suite to observe patients' health while providing improved ergonomics for medics' comfort and safety. The new attachments include extendable handles, with enhanced grip for ergonomic carrying, as well as LCD displays to monitor the patient's vital signs. The basket also includes a face shield and inflatable buoys to protect the patient during land or water rescue SAR rescues. Additional directional lighting enhances the rescue team's visibility during transportation. The LCD screen shows the patient's heart rate, oxygen saturation, surface temperature, and electrocardiogram (EKG) rhythm. Future tests will evaluate the vital signs collected and the overall weight-bearing strength and buoyancy of the basket. Successful implementation of these attachments will provide a valuable addition to the arsenal of rescue tools and will further enhance the ability of rescue teams to operate effectively in challenging environments.

527. Can Coastline Configuration Create Accumulation Points for Harmful Algal Blooms?

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nicholas Tiner

Faculty Mentor: Lauren Ross

Abstract: Frenchman Bay, one of Maine's most important tourist and seafood centers, is under threat due to the emerging presence of harmful algal blooms (HABs). In 2016, the detection of toxic phytoplankton, Pseudo-nitzschia (PN), in Gulf of Maine waters forced closures to shellfish harvesting for the first time. Studies have shown that the formation of gyres in coastal regions can cause the accumulation of material (such as HABs), but the presence of these hydrodynamic features in Frenchman Bay is not well understood. To improve this understanding, North-South and East-West velocity profiles were collected along an approximately 4 km transect over a semidiurnal tidal cycle in Frenchman Bay. Measurements were collected with a vessel-towed Acoustic Doppler Current Profiler (ADCP) and analyzed to investigate gyre formation. Seawater samples were collected along the transect in accordance with the Maine Department of Marine Resources' sampling protocol to measure PN. These measurements were correlated to the hydrodynamic data in order to investigate whether the gyres accrue PN. The results of this study indicate the existence of a gyre in Frenchman Bay forming predominantly during slack tide after flood and ebb. PN cell counts both spatially along the transect and with the tide cycle. Peak PN cell counts coincide with the gyre's presence, which suggests gyres in Frenchman Bay may play a role in the accumulation of HABs. The implications of this accumulation requires further study, however this research provides a more complete picture of the linkage between circulation patterns and material accumulation.

528. Compact VHF and UHF Antennas for Integration with SAW Devices in Harsh Environment

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Sri Lekha Srimat Kilambi

Faculty Mentor: Mauricio Pereira da Cunha

Abstract: Compact omnidirectional antennas are highly desirable for different present-day wireless applications such as smart car keys, radio frequency identification (RFID) tags, tire pressure monitoring system, hand-held communication devices, and high-temperature harsh-environment wireless sensors. This work discusses the design, fabrication, and testing of a compact (~1/25th to 1/10th of a wavelength) helical and microstrip combined structure operating as a normal mode helical antenna (NMHA) around 300MHz. The impact of different orientations of the coil with respect to the microstrip structure and different lengths of microstrip transmission lines on the antenna structure impedance were investigated. It was found that by varying the length of the microstrip line from 0.5 in to 3 in, the resonant frequency of the antenna structure decreased by 3.3%. Different orientations of the coil with respect to the microstrip plane changed mostly the impedance value of the structure, changing the real part of the impedance from 114 Ω to 160 Ω for the orientations measured. Comparison between simulations using two different commercial software packages (ANSYS-HFSS and WIPL-D Pro) and measured frequency responses revealed an agreement in resonant frequency within 5%. This antenna structure is planned to be adapted and integrated with surface acoustic wave devices for wireless sensor operation in harsh environments.

529. A Novel Method of Measuring Bone Density Using Audible Sound

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Evan Bess, Todd O'Brien, Bruce Segee, William Cassidy

Faculty Mentor: Michael Mason

Abstract: Osteoporosis is a medical condition where there is a progressive degradation of bone tissue which correlates with a characteristic decrease in bone density (BD). It is estimated that osteoporosis affects over 200 million people globally and is responsible for 8.9 million fractures annually. Populations at risk for developing osteoporosis include post-menopausal women, diabetic patients, and the elderly, which represent a large population within the state of Maine. Current densitometric and sonometric devices used to monitor BD include quantitative computed tomography (QCT), dual-energy x-ray absorption (DXA), and ultrasound (QUS). All methods are expensive and, in the cases of QCT and DXA, patients are exposed to small, frequent doses of ionizing radiation. While these methods can effectively measure bone density, they are critically limited for applications in rural healthcare because they are cost prohibitive to rural medical facilities and to patients that require routine screening. The diversity of at-risk patient populations, current expensive and invasive BD devices drives the need for a rapid, low-cost, and non-invasive approach to monitoring BD. The present work uses audible sound as a potential solution that could safely and effectively measure bone density by minimizing cost drivers and increasing device simplicity to improve availability. The current prototype aims to measure calcaneal bone density using audible sound attenuation and time delay spectroscopy.

530. Measuring Coupling Force in an Audible, Sonometric Device Prototype

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): William Cassidy, Evan Bess, Todd O'Brien

Faculty Mentor: Michael Mason

Abstract: Osteoporosis is present when there is a decrease in bone density (BD) because of a major degradation of bone tissue. Groups at greater risk to develop osteoporosis are post-menopausal women, patients with diabetes, and the elderly, representing a large section of the population. This generates the need to create a fast and low-cost device to easily screen for osteoporosis. The proposed device focuses on non-invasively measuring bone density of the calcaneus. The device uses audible sound frequencies that are transmitted through the calcaneus and measured. To understand the characteristics of the transmitted sound, a better understanding of coupling force is necessary. Current sonometric devices use deionized water and gels to maximize coupling at the patient and device interface. In this prototype, we used a Grove 2.5 Amp DC Hall Effect Current Sensor to quantitatively assess coupling force of the current prototype. To do this, we wrote an Arduino and LabVIEW script to measure, display, and relate current to coupling force through calibration.

531. Gold Nanoparticle-Doped Liquid-Infused Surfaces for Visualizing Liquid Overlayer Movement and Loss

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Zach Applebee

Faculty Mentor: Caitlin Howell

Abstract: Liquid-infused surfaces are a new technology that is used to create ultra-slippery surfaces for a range of applications that include reducing ice adhesion in transportation and bacterial adhesion in medical devices. However, determining when the liquid coating the surface needs to be replenished or by how much can be a challenge since it is too thin to be seen by the naked eye. We explored methods to incorporate nanoparticles into the liquid coating as a visual way of determining when a liquid-infused surface must be refreshed and by how much, as well as to give easily accessible information about how the liquid coating was being deformed when exposed to droplets of liquid. Multiple methods of adding the gold nanoparticles to the surface liquid coating were tested, including aggregating the nanoparticles so that they could be easily seen and would sink to the bottom of the coating, dispersing them throughout the liquid to create a uniform color, and having them accumulate at the water/liquid interface. The results suggest that the incorporation of nanoparticles into liquid-infused surfaces can provide useful information about the nature and performance of the liquid coating.

532. Abnormal Network Traffic Flow Dashboard Tool

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Brody Looney, Johnathan Driscoll, Sean Staton, Dylan Haughton, Andrew Howe

Faculty Mentor: Terry Yoo

Abstract: The Abnormal Network Traffic Flow Dashboard Tool is being developed by Brody Looney, Jonathan Driscoll, Sean Staton, Dylan Haughton, and Andrew Howe for our client Ben Drozdenko of the Naval Undersea Warfare Center Division Newport (NUWCDIVNPT). This project will give our client a viable means of analyzing traffic that flows through their network in order to protect the integrity of the network. The project serves to detect statistical anomalies and provide a simple yet effective user interface that will display information about the network to the client. The tool will allow for them to take action against any unwanted network traffic. We are developing the project in Python and we are using an integration with Zeek which is an open-source software network analysis framework. The data obtained from Zeek is then fed into a machine learning model. This model is initially trained via existing network traffic flow reports and then has the ability to make predictions as well as continue to train with real-time network traffic. The model that is being used in this project is a random forest regressor which uses ensemble learning methods with a decision tree framework to provide predictions on the data that is fed into it. These predictions are then passed to the user interface to display information that is important to the user such as anomalies in the network traffic. The information is also stored on a database which allows for record keeping and the ability to train the model on previous network traffic.

533. Monitoring Task-important Neurons in Deep Neural Networks Improves Continual Learning

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Joshua Andle

Faculty Mentor: Salimeh Yasaei-Sekeh

Abstract: Continual Learning (CL) is the sequential training of a neural network on multiple tasks, enabling it to operate more efficiently while allowing information from previous tasks to be utilized when learning and performing each new task. Although many CL approaches exist most methods still suffer forgetting, expensive memory cost, or insufficient theoretical understanding. One core requirement of CL is the need to retain information from multiple tasks in a single network, resulting in a loss of information and accuracy. This loss in accuracy can be mitigated by discarding only the least important information. Our work uses the concept of Information Flow (IF), which reflects how well the state of one network node indicates the outputs of the subsequent layer. In the current work we use IF in order to identify which information can be discarded for a task while minimizing the loss of accuracy, aiming to retain the most informative connections within the network. We utilize IF between layers in deep neural networks as a new measure of importance for the weights and neurons within the network. Our goal in implementing IF is to improve CL accuracy across a sequence of tasks. Our empirical application of this approach improves accuracy when applied to the implemented CL baseline method, showing up to a 1% improvement across tasks. Lastly, we investigate the role of IF when deciding which past information to use for the current task in order to better realize the potential synergistic benefits of sequentially training a network.

534. The Influence of Heat and Mass Transfer on the Setting Rate of Adhesives Between Porous Substrates

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Mubarak Khlewee

Faculty Mentor: Douglas Bousfield

Abstract: With the move to replace plastic packaging with sustainable options, glueing operations are needed to form cellulose based packaging. In the setting of hot melt adhesives and water-based glues in the production of paper-based packaging, the controlled penetration of the adhesive is important to obtain rapid setting rates and good bond strength. Experiments are designed to understand the extent of penetration of hot melt and water-based adhesives into several porous substrates. For hot melt adhesive, a layer of the adhesive is pressed against the paper of interest with the carver press, for a known time, pressure, and temperature. The final degree of penetration of both systems is determined with silicone oil, mercury intrusion porosimetry, thickness, weight methods, and Scanning Electron Microscopy. Here, the accuracy and repeatability of these methods are compared. For water-based adhesive, a layer of the adhesive is pressed against the paper of interest with the carver press and peel wheel tests, for a known time, pressure, and adhesive solid contents. In addition, various models are developed to predict the penetration of the adhesive as a function of the fundamental parameters. A finite element method-based model (COMSOL Multiphysics 5.5) is used to solve the unsteady-state flow of liquid adhesives into a single pore or a porous medium where the fluid viscosity is a function of temperature or concentration. Moreover, a model, based on Darcy’s law, is developed that accounts for temperature differences between the adhesive and the paper. Both models showed good agreement for all conditions.

535. A Numerical Exploration in Estimating the Hurst Exponent using Fractal Box Counting

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Melissa Ham

Faculty Mentor: Andre Khalil

Abstract: The CompuMAINE laboratory is interested in estimating the Hurst (H) roughness exponent from 2D mammograms in their current research in breast cancer predictive diagnostics. The lab uses the 2D Wavelet Transform Modulus Maxima and power spectrum methods. The goal of this work is to assess the validity, accuracy, and efficiency of using an alternative method called the fractal box counting algorithm to estimate H. To do this, the author used a Python script to calculate the fractal dimension of an image and ran a series of numerical experiments on fractional brownian motion (fBm) images with theoretically known H values ranging from 0.00 to 1.00 in increments of 0.05. Experiment 1 tested 500 images per H value using the full range of box sizes, and experiments 2, 3, and 4 tested the same 500 images per H value, but removed the first, last, and first and last box sizes of the fractal box counting algorithm. These experiments were evaluated by plotting the experimental H values against the known theoretical values and quantifying the departure from a y=x line. Preliminary results indicate that removing the first box size, where every pixel is counted as a box, gives the best fit to the y=x line. These preliminary results and their speed of computation demonstrate that fractal box counting has the potential to be CompuMAINE's method of choice in determining H, which will be a major asset in their breast cancer research.

536. A New Optical Strain Sensor for Direct Integration into 3D Printed Structures

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Christopher Erb

Faculty Mentor: Caitlin Howell

Abstract: Conventional strain gauges are critical for monitoring material performance across a range of applications. Optical strain measurement systems such as extensiometry, digital image correlation and tracking (DIC) and electronic speckle pattern interferometry (ESPI) are particularly useful in their ease of operation. However, these methods often require expensive and/or fragile components, rendering them impractical for some applications. Our research seeks to develop a low-cost, highly accurate, and fully customizable optical strain sensor for space-based applications. A mass-manufactured nanopatterned material was affixed to the build plate of a stereolithographic (SLA) 3D printer, resulting in 3D printed structures with surfaces that diffract light in predictable ways. ASTM D638-10 Type I tensile test specimens were printed using this technique, then affixed to a test frame. A high-resolution imaging system was used to correlate specimen strain under load to light diffracted by the specimen's surface. Foil strain gauges were attached to the specimens to standardize measured strain with their corresponding reflected wavelengths. An off-the-shelf machine learning algorithm was used in post-processing of the diffraction images to correlate minute changes in the reflected wavelengths to the strain experienced by the specimen. Integrating the material and geometric flexibility of 3D printing into a new type of strain sensor could help reduce the cost of transporting material into space while still providing highly accurate strain data.

537. The Influence of Base Paper and Coating Properties on the Recyclability of Barrier Coated Products

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Aysan Najd Mazhar, Clayton Wheeler

Faculty Mentor: Douglas Bousfield

Abstract: Plastics are widely used in food packaging because of their good barrier properties, but plastics have environmental implications. Paper-based packaging can reach the barrier properties with coatings, but these coatings often make the paper harder to recycle and hard to break down in the environment. Bio-based barrier coatings may be the key solution but recycling of these is not clear. The paper properties, barrier layer type, and other processing conditions that lead to good fiber recovery in a recycling system are not clear in the literature.

This study aims to understand the paper and coating layer properties that lead to poor/good recycling applications which are defined by fiber recovery. The key hypothesis of the work is that high penetration of the barrier coating into the paper leads to poor recycling and poor barrier properties because fibers intermix with the barrier material. The influence of paper properties, pre-coating layers, and types of barrier layers on fiber recovery will be characterized. Various methods will be used to measure paper properties such as water retention value, basis weight, tensile strength, contact angle, pore size distribution, and permeability. Pre-coating layers will be used in some cases to adjust the penetration of the barrier coating layer and to influence the release of the barrier layer upon repulping. Coated samples will be characterized in terms of water vapor permeability, grease permeability, and the sizing contact angle. A lab-based method recycling/repulping test to determine the percent of fiber recovery will be developed.

Moreover, to assess the environmental sustainability of the entire process from making the base paper, applying coatings to its end-of-life, a life cycle analysis will be carried out.

538. Continued Integration of the Kinova Gen 3 Lite Arm with ROS and the Moveit Framework for Object Recognition and Manipulation of Objects

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Aubrey Denico

Faculty Mentor: Vikas Dhiman

Abstract: This research project focuses on the Kinova Gen 3 Lite arm and its use in various applications. The arm can be controlled through various means such as an Xbox controller, preset poses, and most powerfully, with ROS and the Moveit Framework. This last option allows the arm to achieve any orientation and perform complex tasks such as object recognition and grasping with the help of additional technology.

The project aims to mount the arm on a small four-wheel drive robot which can then be used for targeted cleanup tasks in urban environments for example. The current focus is on implementing object recognition via a depth camera and modifying the arm's 3D model to support this setup.

The research has been challenging due to the need to learn the inner workings of subsystems such as URDF files and ROS commands. However, it has been an insightful and rewarding learning experience.

Future research in this area could potentially create the groundwork for a specialized class in ROS, allowing others to build on the project's findings and further explore the possibilities of using the Kinova Gen 3 Lite arm with ROS.

In conclusion, this research project highlights the power and versatility of the Kinova Gen 3 Lite arm when combined with ROS and the Moveit Framework. The ongoing work on object recognition and manipulation has the potential to create a useful tool for many different projects such as the urban environment example.

539. Investigation and Construction of Compact, Quickly Deployed, Radiation-Protected Habitats for Mars

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Stella Cotner

Faculty Mentor: Neil Comins

Abstract: With the push towards colonizing Mars, the focus has shifted from space travel toward habitation. Also known as the red planet, Mars has been thoroughly studied with the intent of colonizing in mind. This dusty planet is not currently suitable for human life due to the lack of liquid water and a breathable atmosphere. Also, Mars does not have a magnetic field protecting it from cosmic radiation and solar winds as the Earth does. It was found that the surface of Mars experiences an average of 2.5 times the levels of radiation found in the International Space Station, but during solar events, such as solar flares, the surface of Mars is exposed to 100 times as much radiation as on any average day. While short doses of radiation are not detrimental, long-term exposure and exposures of this magnitude can cause life-threatening health concern. This project looks to investigate whether a localized magnetic field or water-based shielding would provide the most protection, while taking into account the weight and space that either method would require while transporting it to the planet. This shielding, as well as the martian habitat, should be able to fit within the confines of a transportation habitat. Using previous space shuttle payload bays as a size comparison, the temporary shelter should be able to fit within the 15ft (4.572m) diameter of such a storage area. In order to fit into such a small space, the shelter will need to unfurl to comfortably house a crew of two or more people. To accomplish this goal, the aim of this project is to create a model for a possible habitat based on concepts of origami. The shelter must fit the size constraints laid out, while also providing protection from windstorms and maintaining its shape in the lower gravity environment. This project also aims to provide an extensive literary review and insight into materials that could be used to construct a test model to keep the inhabitants safe from radiation. The success of this project could provide the scientific community with another idea from which to draw inspiration for the future missions to the red planet for colonization.

540. Optical Methods for Image and Video Processing of Nanobubbles

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Arman Kiani, Jaymie Pratl, Kenneth Mensah, Onur Apul, Ali Abedi

Faculty Mentor: Ali Abedi

Abstract: Nanobubbles have become increasingly popular for various applications, such as drug delivery, water treatment, and nanoscale imaging. In this project, we focus on developing a compact optical method for processing image and video of nanobubbles that can fit into a CubeSat. We explore various optical techniques, including bright-field microscopy, dark-field microscopy, and interferometry, and compare their accuracy, equipment, and techniques. By using a high-speed camera, a light source, and image processing algorithms, we demonstrate that blob detection algorithm in python can be used to track and detect nanobubbles in real-time. Additionally, we show that interferometry can provide highly accurate measurements of the size and position of nanobubbles. Our method is lightweight, compact, and ideal for space applications, such as environmental monitoring and biomedical imaging. The results of this project have significant implications for nanobubble-based technologies and for the miniaturization of optical methods in space.

541. A Lithium Tantalate Sensor Platform

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Yuri Trusty

Faculty Mentor: Nuri Emanetoglu

Abstract: A sensor system consists of sample preparation and target analyte capture components integrated onto a sensor platform to document target analyte capture as an electrical signal. Although a significant amount of research has been done on these components, most commercial sensor platforms that utilize electrochemical, optical, and piezoelectric technologies detect only mechanical or electrical property changes in target analyte capture entities. To fully measure these property changes and enhance sensitivity, the sensor platform should be capable of detecting both types of changes. This motivated the present work on piezoelectric lithium tantalate (LT) as an alternative to AT-cut quartz which is used in Quartz Crystal Monitors (QCMs). The QCM sensing element is a room temperature compensated thickness field excited (TFE) pure shear mode (PSM) acoustic wave. A theoretical search in lateral field excited (LFE) LT has identified several orientations which exhibit room temperature compensated PSMs allowing detection of both mechanical and electrical property changes. Further, LT is known to have piezoelectric coupling five times greater than AT-cut quartz, which may provide superior sensitivity compared to the QCM. In this work, a set of LT crystal orientations ranging from (YXwl) -85° to (YXwl) -90° was chosen for experimental verification of these predictions. It was shown that the (YXwl) -87° cut was room temperature compensated. The utilization of an LT sensing platform in a sensor system may have a profound effect on sensor systems critical in agriculture, homeland security, and medical applications where early detection of life-threatening diseases such as cancer is vital.

542. Impact Resistance of Tough Chemically Crosslinked Multiple-Network Hydrogels

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Giacomo Pellizzari, Vincent Caccese

Faculty Mentor: Siamak Shams Es-haghi

Abstract: Tough chemically crosslinked multiple-network hydrogels (single-network, double-network, triple-network, and quadruple-network structures) were synthesized from acrylamide and their mechanical behavior under impact tests was studied using a custom-built drop tower. The building blocks of these tough hydrogels are loosely crosslinked polymeric networks. The water content of hydrogels reduced slightly with increasing the number of networks. The single network (SN) hydrogel had the highest water content (about 93 wt.%) that was reduced to about 87 wt.% for the quadruple-network (QN) hydrogel. The impact tests were performed on the hydrogels at different drop heights. The experiments on each hydrogel were started with the drop height of 10 cm that was then increased by 10 cm for the following experiments which was conducted using pristine samples. Multiple impact tests were conducted on each hydrogel without changing the specimen at different drop heights. For these repetitive experiments, the data points for all the subsequent experiments were almost coincided indicating that hydrogels exhibit identical energy dissipation in all the repetitive tests. The experimental results indicate that the chemically crosslinked multiple-network hydrogels can dissipate the energy of the impactor and the dissipated energy varies by the structure of hydrogels. Based on the results of this project, the multiple-network hydrogels are potential candidates for impact-resistance applications such as shock absorbers.

543. Analysis of Information from Susan G. Komen Database including Mammograms and H&E Stained Histology Images

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Meghan Boos, Molly Olzinski

Faculty Mentor: Andre Khalil

Abstract: CompuMAINE Lab concentrates research on breast cancer focused image analysis including the analysis of mammograms, H&E stained histology images, and Second-Harmonic Generation. An extensive collection of data will be obtained from the Susan G. Komen Tissue Bank at the Indiana University Simon Cancer Center which includes donated breast tissue and imaging data from approximately five-thousand women. With access to the exhaustive database from the Susan G. Komen Virtual Tissue Bank (VTB) the multivariate nature of our analyses will allow for many new projects. Combination of the lab's patented computational mammography analyses with several other analyses such as the anisotropy of mammograms and H&E images, or the analysis of clinical information such as race, body-mass index (BMI), and genetic predispositions will be possible. To do this, all data from the VTB will be downloaded on the CompuMAINE Lab's Linux servers. All files will be downloaded and medical history will put onto a csv file for further analysis using R. Graphs will be formed for all subsets of the clinical information. Curating this database and making it searchable in-house is an extensive project on its own. Using this data, more projects will be formed, such as anisotropy analysis of mammograms and H&E images to determine if there is a correlation between directionality of breast tissue and the prevalence of breast cancer. Our goal is to have this exhaustive database on site in the CompuMAINE Lab on the Linux servers, from which we can investigate several new projects.

544. Crystal Oscillator Circuit Design for Harsh Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Emily Currie

Faculty Mentors: Mauricio Pereira da Cunha, Nuri Emanetoglu

Abstract: Sensors built for harsh environment wireless applications require circuits, including oscillators, which can operate over a wide range of temperatures. However, circuit components such as transistors, capacitors, resistors, and crystals all have temperature dependent behaviors that can compromise the operation and performance of these circuits over temperature ranges of several hundred °C. To build sensors capable of operating under these conditions it is necessary to design circuits that minimize, account for, or compensate for these effects. In this work different types of crystal-based oscillators for operation in harsh environments and as future wireless transmitting sensor units are investigated for operation from room temperature up to 400°C. These oscillators are expected to operate powered by thermoelectric generators (TEG) that scavenge heat energy. The circuit will need to operate over a range of supply voltages output by the TEG. Simulations done with different types of oscillator designs identified seven promising circuit topologies. Four of these circuits have been fabricated up to this stage of the work utilizing quartz AT cut crystals. Room temperature tests showed that the amplitude variation ranges from 8.3% to 17.8% per 1V change in supply power. The frequency variation to supply voltage is below one part per million for all oscillators at room temperature. The signal strength and frequency stability of the oscillators' output over a range of temperatures 0-50°C will be used to further assist in the selection of the most promising configurations for use in the targeted harsh environment applications.

545. Biocompatibility of 3-D Cellulose Nanofiber Constructs with Osteoblast Cells

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Arihant Tallapureddy, Adeola Abraham Fadahunsi, Cameron Andrews, Michael Mason

Faculty Mentor: Karissa Tillbury

Abstract: Bone grafting procedures in patients amount to an estimated $17 billion per year. However, this procedure poses high potential for disease transmission and the risk of autoimmune disorders caused by the introduction of foreign tissue. To address these challenges, recent research has focused on other materials that can mimic the bone, thus eliminating susceptibility to disease transmission. Cellulose nano-fibrils (CNF) is a biocompatible polymer with unique mechanical and physicochemical properties, and can readily form inter and intra hydrogen bonds links to form a composite, thus making it ideal as a bone grafting scaffold biomaterial. This project studied various pure CNF and its composites with 5% Hydroxyapatite (HA), and 2% titanium oxide, 2% polyethylene glycol (PEG). These composites were tested in addition to pure CNF to determine additional beneficial properties that may help promote cell growth and proliferation. The osteoblast cells were seeded at 20,000 cells and cultured with the CNF for a span of five days. The cells were stained using both a calcein stain and FDA stain in order to determine cell growth and confluency. Cytation 5 was used to image the cells that were cultured with CNF constructs and films were observed to have proliferated and grown around and on the CNF. This phenomenon was observed with all CNF mixtures except for the 2% PEG mixture where the cells perished instead. The findings indicate that CNF as well as CNF mixed with 5% HA and 2% titanium oxide promote cell growth and proliferation.

546. Hydrothermal Liquefaction of Waste Plastics and Lignin

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Somtochukwu Anonyuo, Sampath Gunukula, Sampath Karunarathne

Faculty Mentors: Clayton Wheeler, Sampath Gunukula

Abstract: Depolymerization of plastics is one of the most challenging tasks in the chemical upcycling of plastic-based waste because the disassociation of the stable carbon-carbon bonds is only possible at a very high reaction temperature. The increase in plastic contamination of environmental and industrial waste has a large impact on the efficiency of conversion of waste to energy. Lignin is the second most abundant biopolymer in nature, which is currently underutilized. Therefore, it is desirable to find a sustainable solution for increasing the use of underutilized lignin and plastic beyond incineration for energy. Processes like pyrolysis and combustion are associated with energy disadvantages as there is a need to dry the feedstock before processing. However, this shortcoming can be overcome with the Hydrothermal liquefaction technology (HTL) due its ability to upgrade wet materials to value added products like a high-quality fuel. In this research, the effects of HTL process conditions (temperature between 300℃ to 400℃, pressure, and residence time) on the quality and quantity of co-depolymerization of plastics and lignin products are delineated. The dichloromethane solvent is used to extract the organics from the HTL product mixture. We further determine the effect of lignin chemical structure and branching structure of polyolefins on the quality of produced fuel intermediates under supercritical water conditions. Gas chromatography and elemental analysis results will also be used to propose a major reaction mechanism of lignin and polyolefin conversion to fuel intermediates under sub and supercritical conditions. The preliminary results show that the feedstock conversion is found to increase as temperature increases. However, for lignin and Polyethylene (PE), the oil phase yield is seen to be maximum around 370℃ while a decline in the oil yield is seen as the temperature increases beyond 370℃.

547. Determining Nanobubble Concentration Through Acoustic Sensing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jaymie Pratl, Arman Kiani, Kenneth Mensah, Onur Apul, Ali Abedi

Faculty Mentor: Ali Abedi

Abstract: Nanobubbles are stable nano-sized bubbles with a liquid shell and gaseous center. The stability of these bubbles makes them an ideal form of transportation for a variety of materials including oxygen. Such technology possesses the potential to improve the medical field, environmental research, and increase the transportation of oxygen to space. The purpose of this research is to determine new ways to test the concentration and stability of nanobubbles through acoustic sensing. It is hypothesized that the acoustic signal propagation characteristic in water will differ depending upon the concentration of nanobubbles. We plan to design and develop an acoustic transmitter-receiver setup to measure the scattering in various solutions and determine the concentration of nano-sized bubbles using the collected data.

548. Cellulose Nanomaterial Hydrogel Adjuvant for Applications in Vaccine and Drug Delivery

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Jacob Holbrook, Blake Turner, Sairah Damboise, Kora Kukk, Sarah Turner, Deborah Bouchard

Faculty Mentor: Michael Mason

Abstract: There is an ever constant need for novel delivery vehicles for drugs or vaccines. Hydrogels are great candidates for such vehicles since they are able to encapsulate their targeted cargo for prolonged diffusion. One application needing such a vehicle is aquaculture vaccines. While they provide protection, they are also expensive, vary in effectiveness, and use adjuvants that frequently cause adverse effects. New vaccine formulations that maintain or improve the immunopotentiation while reducing cost and adverse effects is desired. Cellulose nanomaterials are a good candidate for this application because they are biodegradable, biocompatible and abundant. The formulation of a chemically modified nanocellulose hydrogel, its shear thinning characteristics and its diffusive properties were studied in detail to explore its potential as an aquatic vaccine delivery system. Surface modification of the nanocellulose hydrogel was completed through amidation onto the initial carboxyl group present in oxidized nanocellulose. This modified nanocellulose is mixed with inactivated Vibrio anguillarum bacteria with a concentration of 1*109 colony forming units per mL (CFU/mL). These hydrogels offer a great potential for use in an injectable vaccination that is able to have long term diffusive properties.

549. Wireless Network Cost and Power Optimization for Near Ground Sensing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Thayer Whitney, Mersedeh Najishabahang, Aaron Weiskittel

Faculty Mentor: Ali Abedi

Abstract: Precision agriculture requires constant monitoring of soil moisture levels throughout crop growth and development to optimize irrigation. Soil moisture wireless sensor networks are commonly used to track changes in moisture content through sensor nodes at the end of irrigation systems. In forested areas, these sensors are distributed across different locations. For optimal performance, both power consumption and reliability are critical factors in these sensor systems. To address this, we are developing a low-cost system design that optimizes the transmitted power using new propagation models. Our objective is to find an efficient system design that balances power consumption and reliability. The largest source of power consumption within these networks are the radios. In order to accurately predict the power required for the radios to effectively communicate, we utilize a near-ground channel model to accurately predict the pathloss of the signal. The forest environment is markedly different from the environments that current models are based on. The model our work uses offers a more accurate model that accounts for the unique low ground and heavily foliaged environment that these sensor networks are deployed in [1]. Our research aims to determine the optimal number and power of wireless nodes in such a network. We will test the effectiveness of our optimized system design and near-ground model in real-world conditions to ensure that it meets the necessary performance.

550. Lobster Trap Acoustic Recorders for Broadscale Right Whale Detection

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Ethan DeMoura, Christopher Tremblay

Faculty Mentor: Nuri Emanetoglu

Abstract: Right whales, an endangered species and their entanglement in lobster trap gear in the Gulf of Maine is an ongoing concern. Due to high cost of commercial equipment, and pushback from fisheries, much of the Gulf of Maine is unmonitored. A low-cost monitoring device that can be attached to lobster traps, and be used collaboratively with the lobster industry for wide deployment, is being developed in this project. The collected data could be used to keep track of whale population, migration patterns, ascertain locations where lobstering does not interfere with whales and to take preventive measures only where necessary. The acoustic monitor consists of a hydrophone, signal processing, data storage and power management systems, all housed in a waterproof case. This sensor would detect the acoustic waves sent out in whale calls as well as any other present acoustic noise. Analyzing the patterns and frequency of the data collected could determine if any whales were detected within the range of the microcontroller and what species was detected. Prototype units were constructed and deployed up to a depth of 150’ in Frenchman’s Bay for 24-hour period, along with a commercial underwater acoustic recorder. An underwater speaker was used to generate test signals which were detected by the recorders, demonstrating that the sensors had a comparable response to the commercial unit, with a detection range up to 2 kilometers. Improvements need to be made in the signal amplification to ensure that whales can be detected up to 10 kilometers away.

551. Scalable Cross-Linking to Reduce the Rehydration-Induced Plasticity of Porous Cellulose Materials for Biomedical Applications

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Cameron Andrews, Mitchell Chesley

Faculty Mentor: Michael Mason

Abstract: The use of cellulose nanofibrils (CNF) in medicine is an emerging research topic, that promises many impactful applications. Current research shows that while the material does prove to have many benefits, there are some potential drawbacks. Uncontrolled mechanical and chemical degradation of the material, in vivo, caused by the rehydration of CNF is a problem that must be understood. A potential solution is to use scalable cross-linking measures that modulate degradation. One such material is polycup, a polyamide-epichlorohydrin, that is thermally activated and is compatible with most biopolymers. Additionally, polycup has the potential to control hydrophobicity/hydrophilicity in the target material system. In the work described here the extent of cross-linking, as well as ASTM compliant mechanical properties are examined. These include tensile and compression modulus, stiffness, and hardness. Recent findings will be presented.

552. Cellulose Nanomaterial Hydrogels for the Delivery of Wild Blueberry Extract

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Blake Turner, Jacob Holbrook, Esther Adekeye, Dorothy Klimis

Faculty Mentor: Michael Mason

Abstract: Wild blueberry extract (WB) has been found to promote tissue vascularization. The phenols present in the blueberry extract were shown to promote angiogenesis in human umbilical vein endothelial cells. Therefore, the extract has the potential to encourage the healing of diabetic foot ulcers and other chronic diseases. Hydrogels are on the cutting edge of drug and nutrient delivery and are a fitting solution for delivering the extract to a patient's wound. Cellulose hydrogels are biocompatible and can be cross-linked using citric acid to create stable gel films. Additionally, the citric acid cross-linker works to preserve the extract in the hydrogel matrix and prevent oxidation . The extent of cross-linking must be carefully controlled in order to affect adequate and controlled diffusion of the extract. The diffusion rate was determined by placing two layers of hydrogel in a cuvette. The top layer was a hydrogel used as an analogous model for skin tissue. The bottom hydrogel contained a known concentration of pigment or extract. As the extract or dye diffuses from the bottom to the top of the cuvette, a UV-Vis spectrophotometer was used to detect the light absorbance in the top layer of gel. Different formulations of hydrogels containing the extract and dye were formulated and the diffusion coefficients were determined.

553. Starvation Feeder for Pellet Fed Gigabot X 3D Printer

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Sam Morton

Faculty Mentor: Gregory Simms

Abstract: While small-scale Additive Manufacturing (AM) uses primarily filament driven systems, research and large-scale AM operations such as the MasterPrint at the ASCC (the world's largest 3D printer) often use pellet-fed systems. The Gigabot X is one such machine and is used as a medium-scale testbed for experimental composites (such as the Wood-Fiber Resin used on BioHome3D). However, one common problem with the Gigabot X system is the pellets becoming clogged at the inlet to the extruder from thermal bridging and pressure from the feed tube. This causes delays, requires constant human intervention, and produces inconsistent print results leading to inaccurate testing. To solve this problem, a Starvation Feeder has been developed to automatically feed only enough pellets as are necessary to print. A Starvation Feeding system will control the amount of material at the extruder inlet, thereby relieving pressure from the feed tube and potentially decreasing thermal bridging.

The Starvation Feeder uses an Infrared Proximity Sensor to detect the pellet-level near the Extruder Input and communicates the sensor output to an Arduino Microcontroller. The Arduino then directs the Stepper Motor and Gear System to the correct action for maintaining proper pellet level. A working prototype has been developed, and functional testing is planned for the near future. A consistent feeding system for these machines will allow fast, unmanned, and consistent printing leading to more accurate testing of experimental composites which are the building blocks for the future of 3D printed materials.

554. Whale Entanglement Reducing Bumper in Lobstering (WERBL)

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Emily Hamby, Casey Casey, Matthew Wood, Nathaniel Lowry

Faculty Mentor: Ali Abedi

Abstract: In lobster fishing, the rope connecting the trap to the buoy at the surface has been identified as an ecological risk. Current ropes are hard to see and highly mobile, increasing the likelihood of whale entanglement and death; With 406 entangled whales reported on the east coast of the US in the past 20 years, taking measures to reduce entanglement is important for helping with conservation of whale species as well as reduce the economic impact on local lobstermen. While looking for possible solutions to further research, we compared factors such as cost, ecological risk, efficiency to install, and likelihood of success. Then, we focused on ways to make the current ropes entanglement-proof, avoiding the need to alter the traps or buoys. We designed a “balloon” device with a sleeve for the rope that is inflated once the set of traps are deployed, creating enough resistance to simply bounce off of any passing marine animals and not wrap around them. It is large enough to not get caught between their flippers and their bodies. We found that durable NBR rubber would work best as it will not erode in salt water. The balloon would be inflated once placed, and enters and exits the water deflated, allowing it to roll up. Reducing cases of entanglement will not only protect local marine life, but also benefit lobstermen and their businesses as it would prevent overbearing conservation legislation while also not requiring the replacement of current equipment.

555. Data-Driven Model Predictive Control for Fast-Frequency Support

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Astha Rai, Niranjan Bhujel, Donald Hummels

Faculty Mentor: Reinaldo Tonkoski

Abstract: Due to the increasing integration of renewable energy resources (RERs) such as wind, solar, battery energy storage, the microgrid is being transferred to converter-based systems. This results in reduction of inertia. Low-inertia microgrids are more prone to larger frequency deviations than bulk-power systems. When there are frequency events, the rate-of-change-of-frequency (ROCOF) can be substantial, leading to significant deviations in frequency. This may activate protection mechanisms, like under frequency load shedding (UFLS), which could result in cascading outages and potentially even a blackout. Energy storage systems (ESSs) can provide fast frequency support to keep the frequency variation within allowable limits. One of the effective control strategies for fast frequency support in ESSs is a model predictive control (MPC)-based strategy. Although MPC offers flexibility in incorporating physical constraints, the effectiveness of the MPC is determined by the accuracy of the predictive model. However, modeling converter-based resources in power systems is challenging due to the different dynamic responses of power electronic converters (PECs) compared to synchronous generators. The proprietary information needed for detailed PEC models makes system-level studies computationally expensive, necessitating the development of accurate and computationally efficient models for stability investigations. In this project, a method to obtain a data-driven model for a microgrid is developed and validated on testing data in MATLAB/Simulink. Followed by a SI-based MPC proposed for frequency support in microgrids. It is compared with the conventional MPC that utilizes a simplified predictive model. The results demonstrate that the data-driven MPC offers lower frequency deviations and rate-of-change of frequency.

556. Reinforcement Learning Based Voltage Support for Microgrid Using Energy Storage System

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Niranjan Bhujel, Astha Rai, Yifeng Zhu, Donald Hummels

Faculty Mentor: Reinaldo Tonkoski

Abstract: Microgrids are very different from conventional grids in terms of size, voltage level, and line characteristics. Due to their smaller size, microgrids are prone to large and rapid voltage deviations. Because of this, some infrastructure projects have been halted (e.g., Honolulu rail transit where power surge required to support train causes power quality issues). To address these challenges, this project proposes the potential of utilizing an energy storage system using a model-free, reinforcement-learning-based voltage support approach for a microgrid. The approach involves using a reinforcement learning algorithm to learn how to control the energy storage system to support the microgrid's voltage during fluctuations caused by sudden load changes. The simulation study was carried out in MATLAB/Simulink using a simulation benchmark from Cordova, Alaska. The results of the simulation study show that the proposed approach can significantly reduce voltage deviations by about a factor of five times. The approach is also found to be computationally tractable, which means it can be implemented in real-time. Comparison of this approach with a state-of-the-art predictive control technique, which is another alternative for voltage support, was also done. The proposed approach has the potential to improve the reliability and stability of microgrids, which can lead to significant benefits for the power sector and society as a whole.

557. Enhanced Removal of 2-Methylisoborneol and Geosmin through Nanobubble Facilitated Sonication

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Zachary Doherty, Sudheera Yaparatne

Faculty Mentor: Onur Apul

Abstract: Potable water is limited on Earth, and even more so in space. Nanobubble technologies can reshape the approach to human sustainability and resource conservation not just here on Earth, but in non-terrestrial applications as well. This project aims to improve understanding of newly developing nanobubble (NB) technology applications in water treatment and explore its potential impacts on existing and future water reclamation systems. NBs are ultrafine domains of gas within a liquid, generally denoted as bubbles under 1000 nm in diameter, though they most often form in the range of 100 nm. We employed a NB generator that harnesses centrifugal separation and mechanical disruption t o create bubbles at the nano scale, breaking apart the fine generated bubbles as they are released into the system. These bubbles exhibit many unique phenomena, especially in conjunction with other removal technologies such as ultrasonication. At the 2022 UMaine Student Symposium I presented experimental confirmation of NB facilitated removal of prevalent taste and odor compounds 2-methylisoborneol and geosmin. These are foul compounds produced by cyanobacteria present in drinking water sources that will cost a city treatment facility of just 300,000 people $1 million every 3-4 years using current removal practices. This year I will build on those results, further optimizing the experimental process to reduce energy consumption and time to removal, by reducing the sonication time and observing the resultant effect on compound concentrations . Additionally, I will seek to further advance the understanding of the compound removal mechanism, focusing on the difference between ultrasonic destruction or NB-compound shuttling to the media surface.

558. Geospatial Meta-Data Portal

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Elliott Weeks, Adam Levinson, Jacob Lorenzo, Peter Clukey, Christian Silva, Connor Bray

Faculty Mentor: Terry Yoo

Abstract: Blue Marble Geographics is a GIS and geodetic software based out of Brunswick, Maine aiming to provide cutting-edge yet accessible products for geospatial professionals and novices. BMG submitted a proposal to the Umaine computer science capstone class outlining a project they have been interested in regarding a geospatial data portal. Currently, there is a lack of an efficient system of sharing large geospatial file types such as Lidar and Raster data, primarily due to the file size and the constraints of existing systems such as google drive. Additionally, being able to visualize certain point cloud data types is not possible without more computationally expensive programs, which can be very inefficient when trying to put together a project for different GIS software's. Using a React TSX front end, with an Express JS backend and a google cloud storage database, we at Pine State Software have created a web application that will not only allow users to upload files into their own portal but will also permit users to share files with one another, like google drive but specifically built for large geospatial files. Moreover, users will be able partially visualize point cloud data using Portree, an open source WebGL based point cloud renderer, when using our application. Our application contains an administrator portal, where Blue Marble administrators would be able to create different company groups, add users to different companies within the application, and remove users from companies already in the system. This process was made possible by using Agile principles of development, and DevOps workflows to facilitate version control and project management.

559. Thermoelectric Generator Powered Oscillator Circuit for Harsh Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nikung Thapa, Luke Doucette

Faculty Mentor: Nuri Emanetoglu

Abstract: Wireless sensors capable of operating in harsh environments are important for monitoring and controlling critical systems in industries such as aerospace, energy, and defense. High temperature oscillators are critical components for these wireless sensors. Silicon based oscillator circuits cannot operate and withstand the temperature conditions beyond 230 °C. Silicon Carbide (SiC) is a wide bandgap semiconductor material that is promising for high temperature applications because of its high melting point, better thermal conductivity than silicon.

This work presents a self-contained and locally powered oscillator platform for wireless data transmission in harsh environments using SiC semiconductor technology and Thermoelectric Generators (TEGs), which can generate electricity from the temperature gradient utilizing Seebeck effect. The high temperature oscillator circuit uses Colpitts oscillator configuration. It was constructed by using a commercially available SiC MOSFET and passive components integrated on an alumina substrate using gold metal traces. The circuit was tested in a furnace while the TEGs were heated using a separate hotplate heater. The oscillator demonstrated stable operation at a wide temperature range from room temperature up to 300 °C, with an oscillation frequency of 4.1 MHz and small frequency drift of 1.3%. A wireless signal was successfully transmitted from inside the high-temperature testing environment to a receiver placed 11 feet (3.4m) away with the signal strength of -47dBm. This system can be extended to support different types of sensors such as temperature, pressure, and vibration sensors and can be used for harsh environment sensing. This work was supported by DOE award DE SC0020126.

560. Investigating the Effect of Bead Geometry on Fiber Orientation and Thermomechanical Properties for Large-Format Extrusion-Based Additive Manufacturing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Joanna Keaton

Faculty Mentor: Roberto Lopez-Anido

Abstract: The relationship between short fiber orientation and thermomechanical properties for thermoplastic composites manufactured by large-format extrusion-based additive manufacturing, more commonly known as 3D printing, must be well understood for engineers to make predictions about material strength based on processing parameters. Fiber orientation is particularly important in determining the thermomechanical properties of the composite material as properties in the direction of deposition are expected to be higher for highly aligned fibers than randomly aligned fibers. Fiber orientation distribution, which is related to processing parameters and deposition conditions, can be efficiently represented by the orientation tensor and can be incorporated in micromechanics models of the composite material to predict thermomechanical properties. This research implements the orientation tensor in a micromechanics model for a short fiber-filled thermoplastic composite material and will validate thermomechanical predictions through a set of experiments. The model will serve to characterize the effect of manufacturing and deposition factors. Two factors were identified to investigate the effect of fiber orientation: the ratio between the deposited bead and extrusion nozzle cross-sectional areas and the aspect ratio of deposited bead geometry. The storage flexural modulus in both the deposition direction and the through-thickness direction were the thermomechanical properties selected to implement the predictive model to investigate the effect of fiber orientation. The expected findings of this research will serve to validate a predictive model that can be used as a rational engineering tool to select manufacturing parameters.

561. Nanoparticles as Local Reporters in Biological Systems: Modeling Signal and Understanding Limitations

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jeremy Grant

Faculty Mentor: Michael Mason

Abstract: As early as 2001, advances in engineered nanotechnologies have caused great excitement about the possibility of using SERS-active nanoparticles as inert, non-toxic, non-bleaching alternatives to fluorescent molecules and quantum dots. Now, nearly 20 years later, there exist few practical examples of the use of SERS-active nanoprobes, despite significant levels of funding and many related publications. These previous works failed because they ubiquitously assumed near-optimal behavior in several key probe factors including Raman cross-section (enhancement), nanoparticle surface loading (number of probe species present), and available nanoparticle concentration (number of particles), all of which are attributable to working in a complex, highly non-ideal biological environment. Here we present a simple scalable accounting model which makes it possible to understand the signal limitations apparent in previous attempts at imaging these probes in biology and allows for determination of likely signal limitations, a key consideration for planning future Raman based imaging experiments.

562. Development of a 3D Breast Cancer Spheroid Migration Model Targeting the Integrin α10β1 Collagen Binding Site

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jordan Miner, Zoe Vittum, Andre Khalil

Faculty Mentor: Karissa Tilbury

Abstract: The growth and metastatic spread of tumors is controlled by the stromal microenvironment and extracellular matrix (ECM). During tumor growth, matrix metalloproteinases secreted by various cell types remodel collagen in the ECM leading to the exposure of cryptic integrin binding sites. These sites play a role in tumor cell adhesion, migration, and proliferation through their interaction with cell surface receptors such as integrins. Recently, one such binding site termed D93 was discovered in collagen types I-V and is recognized by integrin α10β1. Preliminary phase-1 clinical trials demonstrated the possibility of anti-tumor activity while targeting this site with the D93 monoclonal antibody. Therefore, we developed 3D spheroid models using MDA-MB-231 triple-negative breast cancer cells embedded in 2 mg/mL collagen type I hydrogels to explore the D93 site in a system that closely mimics the human body. The goal of this project was to determine how D93 impacts cellular migration using widefield imaging. Two groups were established: the D93 experimental group (20 µg/mL of D93 in PBS) and the control group (only PBS). Spheroid generation was uniform and consistent in area and diameter. The sandwich method of embedding the spheroids in the collagen hydrogel was proven effective with a 95% success rate (n=20) and cell migration was observed at all angles from the spheroid. In our validation trial, early time differences (24 hours) were seen between the groups. Furthermore, fluorescent labeling of D93 was achieved. These preliminary data demonstrate high feasibility and ongoing studies are underway for hypothesis testing.

563. Modeling the Effectiveness of Using Heater and Thermal Insulation to Reduce Cracks on Concrete Bridge Deck

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Maedeh Orouji, Linfei Li

Faculty Mentor: Eric Landis

Abstract: The damage of concrete bridge decks is one of the most severe infrastructure durability issues in cold regions, like New England. Many factors cause the cracking of concrete bridge decks, such as freeze-thaw cycling, chloride-induced corrosion, shrinkage, creep, etc. Among all of them, the temperature difference between the concrete deck, steel girder, and ambient temperature is the one that especially happened at the early age of the concrete hydration process. Because of different coefficients of thermal expansion (CTE) and different thermal conductivities between concrete and steel, a thermal stress/strain is applied at the interface between the steel girder and concrete bridge deck. To tackle this issue, a finite element model was developed in Abaqus to check different temperature scenarios. For this purpose, a steel girder and a concrete deck were designed and modeled in the program. The modeling parameters, such as the ambient temperature, the temperature of the concrete during the hydration process, and the temperature change of the steel girders, were introduced into the model. As proposed solutions by the Maine Department of Transportation (MDOT), setting up extra heaters underneath the steel girders and installing thermal insulation materials above the concrete bridge deck were also included. The modeling result shows that the higher the ambient temperatures are during concreting, the less thermal stress is applied to the bridge deck, which means the cracks are less as well. The thermal insulation materials played a significant role in reducing the number of cracks in the concrete bridge deck.

564. Recycling of Polymer Extrusion-Based Large-Scale Additive Manufacturing Formwork

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Katie Schweizer, Sunil Bhandari

Faculty Mentor: Roberto Lopez-Anido

Abstract: Polymer extrusion-based large-scale 3D printing has recently been used to produce formworks for precast concrete in transportation infrastructure applications. 3D printed polymer composite formworks can potentially be recycled and reused. The purpose of this project is to determine whether the recycled polymer can be used to 3D print new formwork. This will be accomplished by studying material property degradation after each polymer recycling, over five recycles. The two polymer composite materials selected for this study are a petroleum-based composite and a bio-based composite. Key material properties selected for evaluation, have impacts on material printability and performance. The evaluated properties include fiber length, tensile strength, modulus, Poisson's ratio, glass transition temperature, molecular weight, viscosity, and material purity. These properties were determined using ASTM standard test methods, as well as experimental procedures published in the relevant literature. The research approach consists of evaluating key material properties after each cycle of concrete casting and formwork sanitization. The formwork is then recycled and remanufactured. The material properties presented are an established baseline. With these results it is possible to see that the petroleum-based material is less responsive to temperature and on average has a greater tensile strength than the bio-based composite. Effectiveness of the sanitization procedure is also shown in the results, with both materials having an introduced impurity of less than 1%. Using the presented results in comparison with future cycles will show any changes in material properties due to formwork use and recycling. Subsequently, showing the retention of material properties after recycling.

565. Interpreting the Extent and Characteristics of Microplastics Pollution in Maine Freshwater Streams, and Analyzing Nanoplastics and how they Differ from Microplastics.

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Grace Johnson, Taylor Bailey, M. Dilara Hatinoglu, Sean Smith, Lauren Ross

Faculty Mentor: Onur Apul

Abstract: The widespread occurrence of miniscule plastic fragments (i.e., microplastics) in natural waters around the world is an imminent and increasing threat to ecosystems and public health. In Maine, microplastic pollution is especially concerning because the state is one of the largest producers of fish and shellfish in the nation and seafood consumption could contribute to microplastic ingestion. The goals of this project are to develop a system for the detection, interpretation, and communication of microplastic pollution problems in Maine's freshwater streams. The project is ongoing, but initial findings confirmed the presence of microplastics in Frenchman Bay, Maine, and quantified the extent of the pollution. A sampling and analysis method was developed in order to minimize plastic contamination and was implemented in weekly sampling from July through October at eight sampling locations, three freshwater rivers and five saltwater locations. Samples were filtered using vacuum filtration, and then the number of suspected microplastic fibers were counted using a dissecting microscope. Control samples were implemented throughout to determine the amount of microplastic fibers produced by the lab environment. Through counting, an average of approximately two microplastics per liter of water were found. The next step in this project is to determine additional methods of confirming the fibers are made of plastic. Additionally, nanoplastics are currently being researched, as they are a prominent threat as well, but with different characteristics than microplastics. As microplastics break down into smaller fragments, they can become nano-sized, and have different properties and effects than microplastics.

566. Nanostructured Hybrid Electrodes for Electrochemical Detection of Environmental Pollutants

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Sanskar Shrestha, Sharmila Mukhopadhyay, Wenhu Wang

Faculty Mentor: Sharmila Mukhopadhyay

Abstract: Electrochemical sensors are very useful for environmental monitoring and depend upon specialized electrodes.

Carbon nanotubes (CNT) have the potential to significantly enhance the detection limits of sensor electrodes because of their remarkable conductivity and high surface area. The key challenge in CNT electrodes is the integration of these materials into robust and reusable structures to be incorporated into portable detectors.

This research aims to address this challenge by investigating a new class of hybrid-electrodes comprised of CNT attached to RVC (Reticulated Vitreous Carbon) foam, activated with analyte sensitive nanocrystals.

Electrodes were synthesized using Plasma Enhanced Chemical Vapor Deposition (PECVD) and Thermal Chemical Vapor Deposition (TCVD) process. Material Characterization was executed using Scanning Electron Microscope (SEM) and X-ray Photoelectron Spectroscopy (XPS). Cyclic Voltammetry was used to analyze the electrochemical response of the electrode.

The model pollutant in this study is Perfluorooctanoic Acid (PFOA) , one of the most widespread Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). Three different electrode samples were used, bare RVC foam, the RVC foam attached with CNT carpet, and the RVC foam attached with CNT incorporated with tungsten oxide particles for detecting PFOA.

To date, this study has found that RVC foam attached with CNT carpet, and the electrode incorporated with tungsten particles both show promising sensitivity with detection limit of less than 10ppm of PFOA. This may lead to a potential sensing platform for PFAS, a very challenging pollutant.

567. Lipid Production and Biofuel Yield from Wood Hydrolysates using Oleaginous Yeast

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Stephanie Ossai, Clayton Wheeler, Sampath Gunukula

Faculty Mentor: G. Peter van Walsum

Abstract: The United Nations' sustainable development goals seven and thirteen focus on improving the global energy mix and promoting net-zero global greenhouse gas emissions by 2050. Current studies in microbial biofuel production have gained attention due to the deteriorating amount of fossil fuels. Several renewable sources have been explored and extensively used for biofuel production. Oleaginous yeast has been suggested as a viable alternative lipid producer for a more sustainable biofuel industry. Using oleaginous yeasts has various advantages such as: fast growth rate, high lipid accumulation that does not compete with human food, ease of handling, and no environmental or climate effects. Non-edible lignocellulosic biomass is the most abundant renewable bioresource in the ecosphere. It is comprised of polysaccharides (cellulose and hemicellulose) and a natural polymer (lignin). This study explores the use of fermentable sugars as feedstock; produced from dilute sulfuric acid conditioning of white pine tree chips for bio-oil production. Batch fermentation is used to culture the oleaginous yeast strain, Cutaneotrichosporon Oleaginosus, using the hydrolysate as substrates. The hydrolysate contains the sugars glucose, xylose, mannose, arabinose and galactose, and some degradation compounds. Degradation compounds such as hydroxymethylfurfural (HMF), acetic acid and furfural can have a significant impact on the growth of microorganisms, reducing their metabolic rate and the final lipids produced, and presents a key challenge in the biological conversion of the yeast cells. Detoxification of hydrolysates using over-liming and activated carbon adsorption can minimize this challenge.

568. Autonomous Object Stacking

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): David Peitz

Faculty Mentor: Vikas Dhiman

Abstract: Affordable robots and manipulators can bring the benefits of automation to many different areas, including adding mobility to senior citizen's lives. A small, affordable robot that can recognize objects, pick them up, and place them in reach of someone with mobility issues could drastically improve quality of life. It is our goal to utilize existing tools to generate a computer vision pipeline for a small autonomous robot to recognize blocks, generate antipodal grasp points, choose the points with the highest probability of success, and stack the blocks on top of each other. The main objective of this research is to explore what open-source software packages are available for pick and place tasks with mobile manipulators, and how well they integrate with our computer vision pipeline. Our research has covered a broad range of topics: multiview geometry, point cloud generation from depth images, grasp pose detection in point clouds, object oriented programming for robotic operating systems (ROS), convoluted neural networks (CNN) for classifying successful grasp candidates, implementing and resolving dependencies of software libraries, and offloading of computationally expensive software from resource constrained mobile manipulators. This research is important in that it builds the broad knowledge base necessary for the study of robotics, computer vision, and neural networks that is essential for autonomous object manipulation by robotic systems.

569. Using A.I. to Develop Techniques for Energy Efficiency

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Trace Harris, Kacie Bond, Cole Esposito, Conor Melanson

Faculty Mentor: Ali Abedi

Abstract: How can AI be used to bring down energy consumption when growing with hydroponics? Hydroponics is a method of horticulture which involves growing plants without soil. It has become a very popular and profitable method of farming in recent years. However, depending on the crop that is grown, these systems can consume a lot of energy. With this in mind, the concept of the proposed artificial intelligence has the goal of producing cost effective and energy efficient growing conditions for multiple kinds of crops. The conditions this A.I monitors and adjusts include: water and air temperature; light hue; and water level within the hydroponic system. The A.I. will continue to update itself on a regular schedule with the most energy efficient processes to growing a particular crop from data found online. This project strives to not only bring the amount of energy used in a hydroponic system, but to also reduce cost for consumers purchasing the yield a crop may produce.

570. Ring-opening of Thermal DeOxygenated (TDO) Oil Over Synthesized Catalysts to Improve Diesel Engine Properties

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Oluwaseun Salami, Matthew Kline

Faculty Mentor: Clayton Wheeler

Abstract: The need for clean sources of energy is ever increasing in the world today. While the commercial power sector is gaining more engagement, decarbonizing the transport sector still has some room for improvement. Renewable crude oil that has been produced by UMaine's Thermal DeOxygenation Process (TDO oil) is an interesting option as a cleaner alternative to conventional diesel and jet fuels. However, it has many cyclic hydrocarbon compounds, such as cyclohexane, that don't perform well in diesel engines. Breaking the cyclic molecules (ring-opening) can improve the diesel engine combustion properties. Ring-opening is carried out over synthesized catalysts (Ir/SiO2, Ir/Al2O3, Ir/CsBEA and Ir/BEA) to improve the fuel combustion.

TDO oil is produced from decomposition of calcium salts of levulinic and formic acids made from the cellulose in woody biomass. This TDO oil is comprised of many aromatic hydrocarbons, so it is first hydrogenated in a reactor packed with Ni/Al2O3 catalyst. Then, the hydrogenated TDO oil is fed into a trickle-bed reactor that is filled with our novel synthesized catalysts. Reaction products are analyzed on a gas chromatograph mass-spectrometer. The temperature of the reactor and the feed rate of the oil are varied to determine the optimum conditions that yield a mixture of compounds that are predicted to have the best engine performance characteristics.

571. Developing a Neural Network for Obstacle Detection

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nicholas Geiser

Faculty Mentor: Vikas Dhiman

Abstract: Obstacle awareness is a significant challenge for the visually impaired. Without the ability to see clearly, common tasks can become challenging when the individual is not familiar with the layout, or something has changed in their familiar space. This can come in the form of an obstacle in the walking path of a visually impaired individual creating a tripping hazard. Traditional solutions such as a seeing eye dog are still a very common way to navigate the world, however with the rapid development of machine learning algorithms, a model could act as a seeing eye dog. Current technological solutions for the visually impaired tend to be bulky and out of date with the rapid development of machine learning. I propose a new obstacle detection system run on the modern YOLO algorithm to get the best performance on the embedded Oak D camera developed for object detection with a depth map. This allows the algorithm to classify objects, assign the region the user must avoid and deliver the distance the user is from the obstacle to ensure that any hardware solution can appropriately warn the user. The biggest factor in this chain of events is the speed at which the model can detect the obstacle to ensure that the hardware has time to warn the user and for the user to react. The other major factor is how small the detection system can be built to ensure the user is not inconvenienced more by the technological solution than any analog solution.

572. Conductive Ternary Polymer Complex Nanocomposite Sensor with Repeatable, Rapid, Autonomous Self-healing and Unprecedented Mechanical Properties

Submission Type: Poster

Submission CAtegory: Engineering and Information Sciences

Author(s): Colton Duprey, Yang Lu

Faculty Mentor: Evan Wujcik

Abstract: Wearable sensors, stretchable electronics, and many soft robotics materials must have a sufficiently high balance of conductivity, stretchability, and robustness. Intrinsically conductive polymers offer a critical step toward improving wearable sensor materials due to their tunable conductivity, soft/compliant nature, and ability to complex with other synergistic molecules (i.e.,polyacids, small molecule dopants). The addition of nanofillers offers the potential to improve the conductivity of polymers for soft robotics and wearable applications. While nanofillers typically increase conductivity at the expensive of mechanical properties, here we show an increase in both conductivity and mechanical properties, which the interface between the polymer matrix and the AgNW is hypothesized to be integral for the formation of an active conductive network. These form a polymer nanocomposite with high electronic sensitivity, unprecedented mechanical properties (a maximum strain of 4693% at ambient humidity; ~52 RH%), and repeatable, autonomous self-healing efficiencies of greater than 98%. To illustrate the remarkable sensitivity, the material was employed as a biomedical sensor (pulse,voice recognition, motion), topographical sensor, and high sensitivity sensor.

573. Privacy in Development: A Software Development Team User Study

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Maxwell Prybylo, Sara Haghighi

Faculty Mentor: Sepideh Ghanavati

Abstract: With the abundance of consumer information available to software developers and their teams, the burden of making privacy decisions often falls on their shoulders. In this paper we investigate the privacy comprehension of developers and analyze their decision-making processes concerning privacy in their applications. Our study involves an online survey of 175 developers, which quantifies their behaviors and patterns related to privacy comprehension. We hypothesize potential solutions to mitigate the challenges developers face when complying with current and proposed privacy regulations. This study offers valuable insights into the privacy comprehension of software development teams and presents practical solutions to improve the privacy behavior of applications they create.

574. The Eye as a Window on the Heart: Novel Noninvasive Assessment of Cardiac Systolic Function Through Blood Velocity in the Central Retinal Artery

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Mohamed Zaid, Alon Harris, Lorenzo Sala, Marcela Szopos, Sergey Lapin, Alice Chandra Verticchio Vercellin

Faculty Mentor: Giovanna Guidoboni

Abstract: Noninvasive assessments of left ventricular contractility (LVc) are vital to diagnose and treat cardiac systolic dysfunction. Ocular measurements have the potential to provide a window on cardiac function. To this end, this study investigates the relationship between LVc and blood velocity in the central retinal artery (CRA) and how this relationship is affected by intraocular pressure (IOP). For this purpose, a mathematical model of the cardiovascular system, validated on a preclinical swine model for myocardial infarction, is combined with a mathematical model of the retinal circulation, validated on clinical data for healthy and glaucoma eyes, to predict how the CRA velocity waveform changes due to: (i) LVc-induced changes in systemic pressures, and (ii) IOP elevation. Simulation results suggest that LVc reductions induce a decrease in CRA peak systolic velocity (PSV) and end-diastolic velocity (EDV). This decrease is more marked for higher IOP. Notably, IOP elevation has a characteristic effect on EDV, which decreases significantly due to higher susceptibility to venous collapse in the retinal circulation. In conclusion, this study shows that LVc reductions lead to characteristic changes in the CRA blood velocity waveform that are distinguishable from changes related to IOP elevation. These findings suggest that measuring CRA velocity may offer novel noninvasive ocular imaging access to cardiac systolic function, which may open to new experimental research to investigate the relationship between patients' visual field deterioration and their cardiac health.

575. Sodium-Dictated Free-Standing Lignin-Carbon Electrode towards Ultrahigh Capacitance

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Manish Neupane, Zhiyong Cai, Jinwu Wang

Faculty Mentor: Yingchao Yang

Abstract: Lignin is a waste in the paper industry and lignocellulosic biorefineries, in addition to the fact that it is the second most abundant renewable biopolymer on Earth. Converting invaluable lignin to high value-added advanced materials would not only help address the environmentally detrimental biowaste but also satisfy the societal need. Lignin has been tentatively converted into porous carbon, made into slurry, and pasted onto metal (stainless steel or nickel) forms as electrode for lithium-ion batteries and supercapacitors. The bottleneck is to how to largely utilize lignin and simultaneously achieve great area and mass capacitances in the fabricated lignin-carbon electrode. In this work, a thick freestanding electrode coupled by lignin carbon and sodium was fabricated and shows area specific capacitance of 19.7 F/cm-2 at a current density of 1 mA/cm-2, which is three times higher than that of reported freestanding lignin carbon electrode with similar thickness. Furthermore, it exhibits capacitance retention of 86.69% at high scan rate of 100mA/s and 99.5% after 5000 cycles. Additionally, it shows decent mass specific capacitance of 145.74 F/g at 0.5A/g. This excellent electrochemical performance originates from high negative zeta potential and surface area promoted by sodium. This work brings a new strategy towards lignin utilization and energy storage through coupling lignin carbon and alkali metals.

576. Synthesis and Growth Mechanism of Hexagonal Close Packed Two-dimensional Silica

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nuzhat Maisha, Guanhui Gao

Faculty Mentor: Yingchao Yang

Abstract: Among all two-dimensional (2D) materials, hexagonal close-packed (HCP) silica has gained significant attention for its excellent electronic properties and the resulted application in catalysis, energy storage, and electronics. To date, several experimental techniques including wet chemical synthesis and template-assisted method have been adopted to synthesize silica. However, the synthesis of high quality, well ordered, and free-standing 2D silica has rarely been conducted. Herein, we demonstrate a unique way to synthesize 2D HCP silica in an atomically thin layered structure on top of a SiO2/Si substrate using the chemical vapor deposition (CVD) technique. The innovation in fabrication involves the use of a mixture of multiple transition metals along with salt. With controlled growth parameters, high quality individual crystals and films have been successfully obtained. The growth of 2D silica has been detailed by performing experiments with salt only and individual transition metals, leading to the conclusion that group VB metal facilitates the formation of a more uniform crystalline structure compared to other transition metals from group IVB. Regarding the growth mechanism, salt reduces the precursor melting point and elevates reactant vapor pressure, while hexagonal transition metals act as nucleation sites for the growth of 2D silica. The 2D silica samples have been characterized using optical imaging, SEM, EDS, Raman spectroscopy, and TEM analyses. Our work opens the opportunity for studying the electronic and mechanical properties of 2D silica for potential applications in electronics and electrocatalysis.

577. The Scientific Publication Ontology (SciPub): Linking Publications' Content to Domain Ontologies

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Umayer Reza, Xuelian Zhang

Faculty Mentor: Torsten Hahmann

Abstract: The proliferation of publishing scientific articles nowadays is making the extraction, management, reuse, and integrated analysis of scientific knowledge challenging. The knowledge extraction process from scientific articles by humans is time-consuming and inefficient. Information extraction techniques can automate this process and constantly feed structured and detailed domain knowledge into a knowledge-based system in a systematic way for users to subsequently search and analyze the knowledge more holistically. However, such a knowledge-base system needs a computer-readable and logically connected document format of the research articles that are typically published in PDF format. Here we present a model called the Scientific Publication Ontology, in short SciPub, that describes the content of scientific articles by logically linking them with each other so that the information gathered from the articles can be searched through later on. The SciPub ontology is developed using the Web Ontology Language format OWL2 which retains the consistency of explicit and inferred knowledge, and visualized using Protégé which is an ontological model editor and knowledge management system. The interconnectivity between the building blocks of knowledge in a graph database system assists to address the answers to the user's questions more meaningfully. Currently we are using this proposed ontological model to develop a knowledge-based system for the cellulosic domain.

578. Fundamental Evaluation of Nanobubble Mobilization and Generation via Mild, Isothermal Ultrasonic Irradiation

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Kenneth Mensah, Sudheera Yaparatne, Zach Doherty

Faculty Mentor: Onur Apul

Abstract: Advancing water and wastewater treatment technologies is imperative to ensure an effective, safe, and economical water supply for domestic and industrial purposes. Recently, nanobubbles have shown their ability to improve or even potentially substitute some existing water treatment techniques due to their high stability, low buoyancy, high interfacial surface area, hydrophobicity, and ability to generate reactive oxygen species. Hence, investigating the generation and possible applications of nanobubbles is vital to improving water and wastewater treatment technology. This work studied the effects of ultrasonication on nanobubble stability to provide a fundamental framework for the possible application of ultrasounds for enhanced water and wastewater treatment. Ultrasonication rapidly collapsed nanobubbles in distilled water at relatively low intensity under isothermal conditions and had a mild effect on the size of nanobubbles. However, about 80% of nanobubbles collapsed within 30 seconds of nanobubble water ultrasonication followed by a subsequent increase in nanobubble concentration. The collapse of nanobubbles can be ascribed to agglomeration or coalescence of nanobubbles because of Bjerknes forces, which resulted in subsequent shuttling of the large bubbles to the water surface and then collapse. A significant increase in the bubble concentration and size occurred in ultrasonicated nanobubble water after 10 mins illustrating a simultaneous nanobubble generation and, agglomeration and ascension. The mechanism of nanobubble generation, agglomeration, and floatation under ultrasonication, as demonstrated in this work, can be explored as a chemical-free technique to remove surfactants and hydrophobic pollutants from water.

579. An Investigation into Memristors

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Jacob Goldberg

Faculty Mentor: Rosemary Smith

Abstract: This project is an investigation into memristors. Memristors are a basic circuit element that was theorized back in 1971 as the final fundamental passive electrical component. It was theorized mathematically by Leon Chua as an element that linked charge and magnetic flux. The overall goal of this project is to fabricate a device that performs memristor-like behavior, i.e. with non-linear resistivity and non-volatile memory. The combined properties of non-linear resistivity and non-volatility give the memristor unique properties with applicability to the fields of neural networking, signal processing, and large data crunching. The device under investigation is a sandwich made of two conductive metals with an extremely thin layer of insulating material between them. The simplicity of this structure comes with an added benefit of making the design and fabrication of memristors inexpensive, at least comparatively to fabricating transistors. Although memristors are relatively simple to fabricate, controlling the composition of nanoscale thick insulators is challenging. An array of devices has been designed to allow for testing of the volatility and resistivity of multiple sizes of devices. Testing entails measurement of the current versus voltage behavior of completed devices and compositional analysis of the insulating layer. Preliminary efforts have focused on deposition of a graded composition stack of Titanium-Titanium oxides (Ti-TiOx). Testing for this project is iterative, as many changes will be made as new information, goals, and constraints appear and change. The final goal is to produce working memristor like devices.

580. Development of Resistors for High Temperature Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Shannon Scott, Samuel Ruiz, Nuri Emanetoglu

Faculty Mentor: Mauricio Pereira Da Cunha

Abstract: Electronic circuits and sensors capable of operating in harsh environments are needed for such applications as manufacturing, power generation and space exploration. Commercially available resistors are destroyed above 300˚C. In this work, resistors capable of stable operation up to 500˚C after repeated cycling to high temperatures were developed using thick film resistive pastes. These resistors will be used in wireless sensor circuitry. Thick film technology offers small sizes, ruggedness, high voltage capability, and reliable fabrication procedures. These resistive pastes were purchased from DuPont and Hereaus. A series of low valued (0.5Ω-100Ω) and high valued (50kΩ-10MΩ) resistors were fabricated and tested. The resistors are made by depositing a blend of metal and ceramic particles and curing at a high temperature which creates a conductive cermet (ceramic - metal) matrix. Three screen-printing masks were designed for these resistors: the metal contact layer, the resistor layer, and the protective overglaze. High temperature testing included a ramp phase (temperature increased from room temperature to 450˚C at 50˚C intervals), a cycle phase (from 200˚C to 450˚C twice) and an overnight soak phase (twelve hours at 400˚C). During the ramp phase, the temperature was increased from room temperature to 450˚C at 50˚C intervals. Resistors made with the high-resistivity DuPont paste increased by less than 3% from 20˚C to 450˚C, with the exception of the 10MΩ resistors which were 32%. The low-resistivity Heraeus paste resistors increased by 40% in the same temperature range. The variation was consistent and predictable. After heating, both sets of resistors returned to within 0.8% of their original room temperature values. This work was supported by DOE award DE SC0020126.

581. Curating Collective Memory Using AI Art

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Payson Welch

Faculty Mentor: Jon Ippolito

Abstract: Humans have a collective memory that forms a narrative of the past based on world events. Scholars have adopted the term collective memory to mean memories that transcend individuals, a shared world experience. Memory recall however is biased as the emotional states of those memories are reflected upon with hindsight of new experiences. Likewise, AI can be biased depending on the inputs used to train it. The ideal representation of collective memory would be a curated representation from an impartial observer's perspective. This project proposes to use an AI art engine to act as an impartial curator of the present. The project will use images sourced from news and trend data to create geo-targeted pictures of daily life based on the AI's interpretation. Each day new source images will be used to re-train an AI model so that it clearly understands that day's trend images. The AI will then generate new images based on the related trend information essentially combining the day's trends and images into a series of images based on that AI's memory (model). By training the model for a short time with limited data the AI art engine will produce very specific images that are heavily influenced by the training data. By distilling geo-targeted trend data to a single image created by an impartial AI engine the project serves to curate a representational snapshot of each day. The impact of this project is that it will allow individual retrospective contemplation of the collective memory using machine-generated images.

582. 3D Representation of Complex Scenes as Neural Radiance Fields

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jeffrey Eiyike

Faculty Mentor: Vikas Dhiman

Abstract: Neural Radiance Fields (NERF) is a new and powerful approach for 3D scene reconstruction. This technique has gained increasing popularity in the field of computer graphics because of its ability to create high-quality 3D reconstructions with accurate textures and lighting. Until now, other technologies like photogrammetry generates 3D reconstructed from many images with lesser details. Photogrammetry has been around for centuries and has played an important role in many industries. 3D scenes are typically stored using voxels grids or polygons meshes which are not cost-effective. Nerf is a fully-connected neural network that can generate novel views of complex 3D scenes, based on a partial set of 2D images. It accepts a single continuous 5D coordinate as input, which consists of a spatial location (x,y,z) and viewing direction (θ, ϕ). This particular point of the object/scene is fed into an MLP, and the views are synthesized by querying 5D coordinates along camera rays and using classic volume rendering techniques to project the corresponding color intensities (r,g,b) and its volume densities σ into an image. Nerf is typically a data-driven approach that relies on large amounts of image data to train a neural network. This approach offers several advantages over other 3D reconstruction techniques but there are certain drawbacks such as long training time which is one of the major research gaps associated with the method.

In general, each of these techniques has its own advantages and disadvantages, and the choice of technique depends on the specific application and the available data and resources.

583. An Ontology on Properties for Materials Science

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Xuelian Zhang, Torsten Hahmann, Jinwu Wang, Douglas Gardner, Steve Shaler

Faculty Mentor: Torsten Hahmann

Abstract: Aiming to integrate data and knowledge about material properties across the domain of cellulose materials, an ontology named Material Property Ontology (MPO) was constructed using OWL language. MPO defines concepts and relations to cover knowledge about the material properties ranging from atomic properties, molecular properties and macro material properties. It extends the Basic Formal Ontology (BFO) and the ontology for Chemical Entities of Biological Interest (ChEBI) and is informed by domain knowledge from materials science and especially the area of cellulosic materials. It organizes properties into a hierarchy of properties and contains approximately 400 entities and over 2300 axioms.

584. Design and Fabrication of Capacitors for High-Temperature Harsh Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Michael Schmitt

Faculty Mentors: Mauricio Pereira da Cunha, Nuri Emanetoglu

Abstract: Capacitors are an important circuit element used in electronics for functions such as filtering and voltage stabilization. Capacitors for harsh environment applications are investigated in this work. When designing circuits for use in harsh environments, the survivability of a capacitor and the stability of its value at temperatures up to 500 C is a desirable characteristic. For applications at temperatures greater than 200 C, commercial options for capacitors are limited, non-operational, or expensive. For this reason, capacitors are being designed to custom values and manufactured in the lab using materials suitable for high temperatures. Capacitors ranging from 10 pF to 100 nF have been designed and simulated using Agilent ADS. These designs will be simulated in ADS, and manufactured using screen printing. Thick film capacitor techniques, including interdigital structures and parallel plate structures have been simulated and are explored for high temperature applications. Small-valued capacitors (10 pF to 200pF), used for filtering in oscillator and sensor interface circuits, are appropriate to fabricate using interdigitated electrode structures. Therefore, these designs have been prioritized for manufacture. Once fabricated, the properties of these capacitors (capacitance, loss tangent, self-resonance frequency) will be measured across a range of from room temperature up to 500 C. Masks for capacitor fabrication are being ordered to allow for device fabrication and testing.

This work was supported by DOE award DE SC0020126.

585. Understanding Developers Privacy Concerns Through Reddit Thread Analysis

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jonathan Parsons, Mike Schrider, Oyebanjo Ogunlela

Faculty Mentor: Sepideh Ghanavati

Abstract: With the growing global emphasis on regulating the protection of personal information and increasing user expectation of the same, developing with privacy in mind is becoming ever more important. In this paper, we study the concerns, questions, and solutions developers discuss on Reddit forums to enhance our understanding of their perceptions and challenges while developing applications in the current privacy-focused world. We perform various forms of Natural Language Processing (NLP) on 437,317 threads from subreddits such as r/webdev, r/androiddev, and r/iOSProgramming to identify both common points of discussion and how these points change over time as new regulations are passed around the globe. Our results show that there are common trends in privacy topics among the different subreddits while the frequency of those topics differs between web and mobile applications.

586. Improved Water Vapor/Air Separation Permeability, Selectivity and Thermo-mechanical Properties Demonstrated in Silylated CNC/PDMS Hybrid Membrane

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Nasim Alikhani, JInwu Wang

Faculty Mentor: Ling Li

Abstract: The hydrophilic surface nature of cellulose nanocrystals (CNCs) has limited their application as a nano-reinforcement in hydrophobic polymer composites, such as polydimethylsiloxane (PDMS). To address this issue, a silylation process was employed to modify the CNCs, to improve compatibility with polydimethylsiloxane (PDMS) polymer.

A silyated CNC/PDMS composite membrane was manufactured, which has applications in air dehydration. For this purpose, the spray-dried CNC powder was dispersed in a solvent, and the surface modification of CNCs was carried out through the reaction between hydroxyl groups of the CNCs and the silylation agent. Finally, the silylated CNCs (SCNCs) were added to the PDMS solution to make SCNC/PDMS membrane samples with an SCNC weight concentration of 2%.

Characterization analyses of FTIR and XRD of SCNCs confirmed the effectiveness of the silylation. The morphology and dispersion of the silyated CNCs within the polymer matrix were investigated using scanning electron microscopy (SEM), atomic force microscopy (AFM), and polarized light microscopy (PLM), revealing improved dispersion of the silyated CNCs in the PDMS matrix compared to unmodified CNCs.

The SCNC/PDMS membrane showed an increase in water vapor permeability by up to 23% and an increased selectivity of water vapor/Nitrogen gas. In addition, SCNC/PDMS membrane showed better transparency than the CNC/PDMS membrane. Thermal and mechanical behaviors of the SCNC/PDMS membrane samples are under investigation.

587. Evaluation of Bayesian Learning Approaches for Safe Control

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Masoud Ataei

Faculty Mentor: Vikas Dhiman

Abstract: Ensuring the safety and stability of the autonomous systems during their operation is critical. Risk-Aware Control Lyapunov Function-Control Barrier Functions (CLF-CBF) in a forward invariance way guarantees safety and optimizes the control program to reach stability in the shortest possible way. Risk-aware controller needs the probabilistic models to capture the uncertainty of the environment. Although finding the system dynamic of a robot analytically is complicated due to the complexity of the model and unavoidable noise in the world and system, Bayesian techniques can be used to learn the probabilistic model by collecting data associated with uncertainty from the environment and estimate the true uncertainty.

In this study, we compare the performance of several Bayesian models including Ensembling, Stochastic Weight Averaging-Gaussian (SWAG), and Bayesian Neural Network (BNN), with a baseline (standard neural network with a fixed uncertainty) in terms of time consumption, complexity, variance, and loss. We evaluate these techniques while they have been used beside a risk-aware controller in a simulation where the system is an unmanned ground vehicle and the objective is to reach the destination without colliding the obstacles. The model initializes with unknown system dynamics and will learn the system dynamics during the safe and autonomous operation. We aim to evaluate the effectiveness of various Bayesian techniques in developing risk-aware controllers that can guarantee the safety and stability of autonomous systems.

588. Simulation and Characterization of a High-Temperature Pierce Oscillator Circuit

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jude Zanoni, Mauricio Pereira Da Cunha, Luke Doucette

Faculty Mentor: Nuri Emanetoglu

Abstract: Machinery operating in high temperature environments is common in industries from factory manufacturing to oil drilling. Failures in these environments are catastrophic, and sensors capable of monitoring equipment operating in harsh environments are essential. In this work a high temperature Pierce oscillator circuit was designed, simulated, and manufactured. The circuit was designed with a silicon-carbide (SiC) based metal-oxide-semiconductor field effect transistor (MOSFET) common source amplifier gain stage and an LC tank circuit resonant stage. The transfer function of the circuit was modeled in both MATLAB and Microcap to predict the circuit's operation and to derive its oscillation frequency. Every component used to implement the circuit was either purchased to operate at high-temperature or manufactured with temperature-resistant materials. The circuit was fabricated using thick-film screen-printing on an alumina substrate using gold paste, and the components were wire-bonded with gold 4 mil wire. Experiments were conducted to characterize the circuit operation at high temperatures, including ramping up to 350°C. Two circuits were manufactured. The first circuit was observed oscillating at 3.45MHz at 350°C with an amplitude of 5Vpp for a 5V input, decreased from 7.36Vpp at room temperature. The second circuit was modified to address observed issues and is currently being tested. It was observed oscillating at 3.68MHz at 100°C with an amplitude of 5.68Vpp for a 5V input, down from 6.56Vpp at room temperature. 3.68MHz was within 10% of models of oscillation frequency in both MATLAB and Microcap.

This work was supported by DOE award DE SC0020126 and NSF grant 1851998.

589. Use of UV Irradiation on Photo Isomers to Enhance the Removal of Lignin From Woody Biomass Hydrolysate

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Dipesh Karki, Sampath Gunukula

Faculty Mentors: Peter Van Walsum, Sampath Gunukula

Abstract: Conversion of lignocellulose to bioproducts and biofuels is often initiated with a hydrolytic pretreatment process that helps to depolymerize the native polymers in biomass and produce a cellulose-rich pulp stream. Extracting dissolved components from this hydrolysis is crucial to derive value from biomass components other than cellulose.

The mildly hydrophobic components in the hydrolysate, such as dissolved lignin, and dehydration products, such as furfural or levulinic acid, are often recovered using liquid-liquid extraction. Recovery of the desired extracts from the solvent typically involves distillation or back extraction, both of which have high energy demands. In this investigation, we propose a novel method to enable the precipitation of desired solutes using photo-isomers in the extraction solvent. The azobenzene moiety is stable in its linear trans-isomer but will isomerize when irradiated with UV light into the more polar/bulkier cis-isomer. The cis-isomer interacts differently with the extraction solvent and changes the solubility of the lignin in the solvent. In this study, three solvents: hexanol, ethanol, and acetone, were combined with three photo-isomers: azobenzene, diethylamino azobenzene, and diethoxy-azobenzene. Among these combinations, the acetone and diethoxy azobenzene solution was most efficient at precipitating dissolved lignin in response to UV light exposure. The charging (isomerizing to cis) was done by exposure to 365 nm UV light, whereas dis-charging (re-isomerizing to cis) occurred through exposure to visible light. Experiments with this system provide insights on concentrations, precipitation, and charging/discharging time durations. The system effectively precipitated Organosolv lignin from a mixture of acetone and diethoxy azobenzene. The precipitated lignin was recovered by passing the solution through a filter paper. The concentrations of diethoxy-azobenzene in acetone were varied, and the amount of precipitation was recorded. It was found that the precipitation increases with an increased amount of photo-isomer until a certain point, after which the shading effect comes into play, and thus isomerization becomes limited.

590. Assessment of Tidal Dynamics in Penobscot River

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Engiliyage Lakmali

Faculty Mentor: Kimberly Huguenard

Abstract: Penobscot river is a tidal river. Its sea outfall is located at the Penobscot bay and the tidal impact from the bay governs the river flow up to several miles along the river. As tides propagate inland, they become distorted by channel geometry and river discharge. The city of Bangor, Maine is one of the main urban cities located in the upstream of the river. Finding the tidal limit of the river and tidal constituents' variation along the river is one of the key points to study, since it creates a way to identify the storm surge impacts along the river to the Bangor city. This study aims to identify the landward extent of the river with tidal influence from the bay and the variation of tidal constituents along the river from downstream to upstream. TELEMAC hydrodynamic model is used for the model simulations and four modelling scenarios are used for the analysis. The TELEMAC model was calibrated to the Bangor measured water levels. Six spatial points are used to extract water levels from the models. The water level comparison results indicated that the tidal limit it located about 48km upstream of the river closer to Eddington. Tidal analysis shows that the M2 increases up to Bangor and dramatically reduces afterwards. The M4 and M6 constituents increase with the upstream distance along the river. Upstream river discharge from the Penobscot river significantly impacts the tide-river interaction of along the estuary. The tidal dynamics in Kenduskeag and Penobscot river confluence appears to be more complex, due to its flow structure and a Delft 3D hydrodynamic model is under development stage for further understanding of the tidal behavior of the Penobscot river especially during a storm surge.

Arts

601. The Cookbook Artist's Book Hybrid and Community: Putting Research to Practice

Submission Type: Exhibit

Submission Category: Arts

Author(s): Rachel Church

Faculty Mentor: Susan Smith

Abstract: This project is putting to practice my research on community cookbooks as tools for documentation and creation of community, and the reorganization and analysis of work that is happening in the intermedial space between cookbooks and artist's books. To bring this research out into the world, I am collaboratively creating a cookbook with the community of Portland, Maine, and more specifically, the community of the Portland Public Library and their upcoming Sustenance art exhibit. As part of the exhibit, I am installing a physical cart/podium in the gallery that includes a call for recipes, food stories, and images from the visitors and contributors of the exhibit. The cart will have paper submission forms that can be filled out on the spot and dropped into a submission slot, but also information to access an online submission form if they prefer, both available in many of the languages commonly spoken in Portland today. Having this act take place in a gallery space, thus declaring it art, signifies that this act is special and worthy of contemplation as presented through the work of Jacque Maquet and Ellen Dissanayake. After the exhibit closes, a cookbook will be produced with the recipes, stories, and images submitted and available to the Portland Public Library community through physical book check out and online e-book, also in those same commonly spoken languages to provide access to as many community members as possible.

602. Modern Art Is So Banal

Submission Type: Poster

Submission Category: Arts

Author(s): James Winters, Raven Wind

Faculty Mentor: Susan Smith

Abstract: James Winters divides his time between still photos and playing jazz here on campus. He earned an MFA at UMaine in 2019. His research more specifically is about the historical pianist Sun Ra along with the hope of expanding jazz education to potentially include sometimes ritual, theatrics, or free improvisation. Through sound and sight, he connects his art to the universe.

603. Like a Terrible Fish. The Intoxicated Values of Beauty

Submission Type: Poster

Submission Category: Arts

Author(s): Cecilia Andrade

Faculty Mentor: Susan Smith

Abstract: The intoxicated values of beauty, amplified by the mainstream media, shape women to see themselves as objects. The woman's self-objectification generates a series of negative consequences including body dissatisfaction, anxiety, self-disgust, depression, eating disorder, lower confidence, and lower ambition. My artwork shifts between the poetic and the political, exploring the distortion of the traditional film narrative, and experimenting with the Berthold Brechtian concept of the distancing effect, Verfremdungseffekt. As a collage, my work is metaphoric, overlapping layers of symbols, meanings, sounds, images, and actions, in kinetic energy to portray a nonsensical reality that intentionally resonates with the hidden work of the subconscious mind. Similarly, to what happens inside the human brain, going through several thoughts at the same time, this complex and enigmatic organ can generate parallel interpretations of reality through thousands of neural connections. Inspired by Surrealism, Confessional Poetry, Experimental Film, and Theatre of Cruelty, all these artistic ideas were absorbed and manipulated to construct this creative project. The poem The Mirror, by Silvia Plath, which I tried to give form through my video, reflects this duality between empowerment and prison, sometimes seeking stability, sometimes unveiling feelings, and sometimes hunting us. By researching the relationship among media, women, and mirrors, it becomes evident that the construction of women’s image must be thought critically. In a society where the media shape cultural norms, we are led to believe that women's power and value lie in their youth, beauty, and sexuality, rather than in their leadership abilities.

604. Expressing Feelings About Death Through the Creation of Art

Submission Type: Exhibit

Submission Category: Arts

Author(s): Lia Davido

Faculty Mentor: Susan Smith

Abstract: Death is a fact of life, yet researchers such as Caitlin Doughty, Todd Harra, Ernerst Becker, and others, have found that people deem death a taboo topic of conversation to be avoided. Doughty herself started a whole social movement, death positivity, to encourage this taboo to be broken, and to normalize talking about death. However these researchers published their findings in the early to mid 2010's, before a major pandemic made death an everyday occurrence for people. This project seeks to start answering the question: Does death remain a topic we refrain from discussing, or has it become less stigmatized.
Through this art research project people will have the opportunity to directly respond with their thoughts about death, and their level of comfort discussing it. People will have the chance to create this response using flowers and embroidery thread. Using the language of flowers, each bloom will have an associated meaning, such as Wormwood for bitterness, Fern for fascination, basil for hate, and more. For things that cannot be said simply using the meaning of these flowers, there is also embroidery thread. The thread will give people the opportunity to give more detailed answers. Using an arts based approach, people will have a freedom to express their answers in any way that makes them comfortable, and encourages conversation through the curiosity others may have about specific pieces.

605. Memories, Scrapped

Submission Type: Exhibit

Submission Category: Arts

Author(s): James LeBlanc

Faculty Mentor: Susan Smith

Abstract: Polaroid film is a unique form of photographic memory because of its limitations and aesthetics. There is only one physical copy of each image, and once it is destroyed, there is no retrieving it. With this project, I explore this question: “how reliable is a memory?” I have examined my relationship with my own memories through dissection and reorganization. Beyond the immediacy of the moment a picture is taken, the image finds its way out of the camera and lives in a suspended time. This project challenges our notion of time, place, and the emotions that surround and are affected by memory.

The album’s frame and all text throughout the piece were designed in Adobe Illustrator and cut/engraved using a Universal Laser. The images are from my private collection and were delicately dissected and arranged.

The project elicited more personal connections in my audience than I anticipated. Complicated feelings tied to memories are universal, but the connections of my viewer to the text were unique in every case. I learned while conversing with one patron at the Intermedia Open House that the text and visual revisions reflect the symptoms of dementia. Although thinking of the past may be uncomfortable, having the power to change or destroy those reminders can be cathartic. I end the album with the melancholy line “all photos fade” to emphasize the temporality of memory and the photos we use to remember.

606. Gabby's Swing

Submission Type: Poster

Submission Category: Arts

Author(s): Alexandra Rose

Faculty Mentor: Susan Smith

Abstract: The arts are known for their ability to reach out and communicate with many different people. However, there is still a division among the audience, with some people finding gallery and museum settings inaccessible and overwhelming. With this project, there is an interest in art that can travel outside of these traditional landscapes and provide both joy and benefits to the children with special needs who interact with it. Also, as those without special needs encounter the work, there is an opportunity to develop bridges among different communities.

Currently, sensory swings are tools used in classrooms and homes to help release energy, focus on communicated goals, and create connections through play. While benefits are clear, mass-produced designs currently available lack the personalization that enables the swing to serve the needs of a particular child, and even empower children by involving them in the design process. This project, Gabby's Swing, provides an answer to this problem and fosters relationships along the way.

Conversation and time spent with Gabby, a third grade student, informed the creation of this unique tactile and textile wrapped swing, fabricated in my studio. The work elevates her preferences, comforts, and voice. Gabby is so much more than her autism diagnosis and this swing helps to humanize her and others alike. As an artist herself, it is important that the swing become a space for Gabby to create in comfort and safety. Anyone who peeks their head inside will gain a small glimpse into part of Gabby's world.

607. Climate Action at the University of Maine: A Documentary (Short Film) that Engages with Qualitative Research Methods

Submission Type: Exhibit

Submission Category: Arts

Author(s): Santiago Tijerina

Faculty Mentor: Michael Grillo

Abstract: Fossil fuel divestment is central to the discourse surrounding climate change, nevertheless, it is a movement driven by student activists and it is a sign of institutional change at a global scale. "Climate Action at the University of Maine," written and directed by Santiago Tijerina, is a documentary short film concerning the rise of student activism at the University of Maine and the recent decision of the Board of Trustees to divest from fossil fuels.

The subject matter of this documentary short film seeks to explore human dimensions of climate change and to advocate for important causes related to climate change. As a media advocacy project that will be used as a catalyst for change, this documentary short film also seeks to amplify the mission of the student organization, "University of Maine Climate Action (UMCA)," formerly known as, "Divest UMS."

Engaging with qualitative research methods is at the center of the fundamental knowledge, skill set, and expertise of a documentarian and visual storyteller. This carefully crafted story engages with ethical visual storytelling in addition to qualitative research methods as it features interviews with student activists at the University of Maine, local community leaders and political figures, as well as the voice of a Distinguished Maine Professor.

Under the guidance of a faculty mentor and a committee of experts in journalism, film production, and visual storytelling, this undergraduate creative activity will fulfill the requirements of the honors thesis. It will be accompanied by a formal disquisition and critical analysis on the subject matter, as well as a discussion on the theory, best practices, and methodology of documentary filmmaking. Finally, this documentary short film is a testament to the director's advanced understanding of cutting-edge camera operation, lighting techniques, audio production, and industry-standard audio and video editing software.

608. Beyond the Riverbed

Submission Type: Exhibit

Submission Category: Arts

Author(s): Jenna Davenport

Faculty Mentor: Susan Smith

Abstract: Beyond the Riverbed explores the unseen displacement that occurred in Maine's natural history. Maine was once the lumber capital of the world, but with that came detrimental effects on the natural environment. Log drives were essential to the transportation of trees to be made into lumber. Two main points of environmental concern with log drives were deforestation and the effects of dynamite used to break up stuck logs.

While deforestation and the effects of dynamite are the main environmental issues associated with log drives, there is more than meets the eye. While some stuck logs were blown with dynamite, sunken logs were left to live on the bottom of the river. These sunken logs created a chain reaction of issues, with the end result being the population decline of brook trout. A decline in brook trout resulted in a predictable decline in predatory species and an increase in brook trout prey. Although the brook trout population decline was an unseen, and often unheard of, result of the lumber industry's actions, it was a significant example of how our actions have consequences in regards to ecology and the processes of the natural world.

Lumber and artificial moss were used to create a patchwork riverbed complete with wooden river rocks. Peach-colored acrylic paint is representative of the underbelly of brook trout – pointing directly to the unfortunate effects of our state's past decisions. Manmade materials constructing a natural environment confronts the viewer with both the past and present of the lumber industry and implores viewers to question their own relationship with the natural land.

609. Intermedia Nanocellulose Artistic Research Team

Submission Type: Exhibit

Submission Category: Arts

Author(s): Walter Greenleaf, Shahab Andarva, Luke McKinney, Alex Rose, Augusta Sparks Farnum

Faculty Mentor: Susan Smith

Abstract: The University of Maine's Process Development Center (PDC) has graciously allowed students of the Intermedia MFA access to relatively vast quantities of cellulose nanofiber (CNF), a cutting-edge bioproduct currently in development, so that we can explore its potential material properties. CNF is derived from a diverse and promising spectrum of natural sources, including wood, algae, chitin, and upcycled cotton fabric, and is expected to alleviate dependance on plastics and the harmful chemicals associated with their creation. However, though research on nanofibrillated materials such as CNF has progressed around the world for over a decade, only rarely are they explored outside of a laboratory context.

Artistic Research is a form of inquiry that centers an artistic practice as an academic field that produces new knowledge, challenges existing conventions, and contributes to the development of cultural production. When CNF is employed in artistic pursuits, the investigation leads to new findings and access points along the research continuum, for and through the operation of a community. To that end, we have formed the ad-hoc Intermedia Nanocellulose Artistic Research Team (INART) in order to establish a closer bond between Intermedia and the PDC, foster a community movement of CNF-related art work/play, and begin undertaking larger projects.

The members of the INART bring an array of creative and scholarly disciplines to their individual work, but our work as a collective is an interdisciplinary act of translation to support the democratization of cultural production.

610. Essentials

Submission Type: Exhibit

Submission Category: Arts

Author(s): Jake Michaud

Faculty Mentor: Susan Smith

Abstract: This collection of photographs showcases cherished objects that hold a particular spiritual, sentimental, or emotional significance. In my pursuit for both levity and understanding through my artistic practice, I've decided to explore the concept of religion and the sacred in the form of objects. In this photo series I try to explore the concept that one's own religious path is the one they use to orient themselves to the world. In this project I have presented portraits of community members and my fellow students who use certain objects to help orient and connect themselves to the world around them, whether in a traditionally religious way or not. In order to highlight the "anchoring" or "grounding" quality that makes these objects so significant to the lives of the owners I have layered photos of the objects themselves with the portrait as a background. The photographs are captured using my Nikon D3200 DSLR and a 35-105mm lens. The files are then imported into Adobe InDesign where I place the backing image and layer additional images over it at decreasing opacities to create the desired effect. By forcing the audience to pause and orient themselves to the image and the object(s) depicted, these composite photographs in a sense become essential for a time, functioning in a similar way to the objects in question.

611. Two-dimensional Surface Spacial Illusions in Virtual Space

Submission Type: Exhibit

Submission Category: Arts

Author(s): Thomas Griffith

Faculty Mentor: Susan Smith

Abstract: I propose creating and presenting a virtual world media project titled Two-dimensional surface spacial illusions in virtual space at 2023, the University of Maine Graduate Symposium. I am a graduate student in the IMFA program here at UMaine.

One of my core focuses as an artist, and a graduate student is on the embodiment of virtual world spaces. Digitally simulated spaces have a clear connection to humans' rich history of creating the illusion of three-dimensional space on two-dimensional surfaces. As a means of art-based research, I am creating a building in the virtual world of Second Life that utilizes two-dimensional illusions intended to distort the user experience of the virtual space.

By allowing people at the symposium to explore this space on a computer and large monitor, I can engage with people and receive immediate direct feedback on how they experience this virtual space. I will also invite other Second Life users to visit the space during the symposium to make it an experience that can be shared between people from any place in the world.

612. Syrinx - Solo for Flute

Submission Type: Exhibit

Submission Category: Arts

Author(s): Madelin Sintiris

Faculty Mentor: Elizabeth Downing

Abstract: I will be performing Syrinx by Debussy and describe the story behind this groundbreaking piece.

613. IRAN

Submission Type: Exhibit

Submission Category: Arts

Author(s): Shahab Andarva

Faculty Mentor: Susan Smith

Abstract: My home country IRAN faces a revolution from protests in the streets that started because of the death of a Kurdish girl, Mahsa Amini, who was beaten by the morality police in Tehran due to not having a proper hijab. Protests continued all over IRAN.
The project uses a black canvas mounted on an illuminated box and placed on two pedestals. The canvas contains a white line of the country with holes made by a knife representing places where people were killed. There are Band-Aids on the pedestals and over the holes. These Band-Aids show the names of the people who were killed. Because the Band-Aids do not fully cover the holes, light from behind shines through.
The inspiration for this project comes from the part of “Rumi and Shams Tabrizi’s” conversation (two old famous poets of Iran):
- Rumi: “So what will become of our wounds?”
- Shams: “Light enters us from these wounds.
A video of the performance of this project will be presented.

614. Deep Mapping Wrangell-St. Elias National Park

Submission Type: Poster

Submission Category: Arts

Author(s): Luke McKinney

Faculty Mentor: Susan Smith

Abstract: Deep Mapping Wrangell-St. Elias (WRST) is a project that takes an artistic approach to investigating, interpreting, and translating the vast wilderness of the United States' largest national park. As the name implies, this project follows an ethnographic deep mapping ethos that collects and correlates a wide range of materials, objective and subjective, to expose a more complicated, comprehensive, and temporally expanded conception of place.

Through engagement with the local communities, scientific and historical literature, and environment itself it is my goal to create artworks that offer thick descriptions of WRST. These works allow the viewer to better understand the specious symbols we use to represent the environment, the ways their perspectives are projected onto the landscape, and humanity's inherent interconnected position within Nature.

This work builds upon constructivist mixed-method approaches that mirror that of Socially Engaged Art. While living in a two person backpacking tent, or occasionally cabin sitting, within the WRST, I spend my days wandering the landscape on foot, by small plane, or by river raft while dialoguing with locals, environmental scientists, seasonal workers, and tourists. It is in these conversations that other perspectives, experiences, and knowledge lead understanding to a new depths of connecting to the continuums of culture, history and habitat. Through collaborative efforts and barter economies, I then produce catalogs of data consisting of photographs, video, audio, GPS markers, stories, and physical objects that become the materials for my artistic multimodal expositions allowing viewers to gain awareness of their own relationships to the documents.

615. Disruption of the Artist: AI Generated art in the Art World

Submission Type: Exhibit

Submission Category: Arts

Author(s): Kacie Bond

Faculty Mentor: Michael Scott

Abstract: Disruption of the Artist: AI Generated art in the Art World. How will this affect art as we practice it today? AI Art is one of the newest forms of art creation today, constantly evolving and improving. It can be used for a number of things, creating logos, paintings and photographs alike. But what does this mean for the artists AI attempts to mimic? Interviews with professionals in related fields, current examples, and the opinion of regular people were used to guide this research and assist in answering this question. Research also analyzes five AI generators that create images, all ranging in sophistication and cost of use to explore the accessibility of them.

Currently there are many differing opinions regarding this topic, even between artists. Some see it as a tool that can be used, while others see it as a way to replace human made art, either way these AI generators are evolving quickly. Presently there is no way to tell how this will, without a doubt, impact artists as a whole, but individuals could test how their own works are perceived in comparison to AI. This project includes a process for other artists to follow, and a physical installation that is used as both an example of this process and case study for this research. Results of this are further explored in the conclusions of the research.

616. TEXT(ile)

Submission Type: Exhibit

Submission Category: Arts

Author(s): Jessy Brainerd

Faculty Mentor: Susan Smith

Abstract: These works explore the intersection of personal and private. From family diaries written in the early 1900s to anonymous secrets written on index cards – these texts are painted with thread onto individually sourced textiles relating to their content. These collected words are turned into templates for hand embroidery onto the materials.

The author of the diaries likely never imagined a great-grandchild would eventually use thread to publicly share her words. The individuals who put their index card secrets into the large manilla envelope knew that they were to be a part of an art project, but weren't aware of what shape that would take.

As I sew, I focus on one word, one phrase, one sentence at a time – occasionally rubbing my eyes and holding the project an arm's length away to see if what I'm stitching matches the source material. I can spend an hour on a phrase written by someone with disjointed handwriting, and as I take ownership of my art piece, in some ways I take ownership of the text.

617. Radiograph Reimagined

Submission Type: Exhibit

Submission Category: Arts

Author(s): Grace Heiting

Faculty Mentor: Susan Smith

Abstract: The field of healthcare is constantly producing new tools and techniques to keep up with the challenges of a rapidly developing world. Many advancements seek to improve efficiency and widen the scope of healthcare, causing apprehension that the quality of the patient-provider connection is overshadowed by the quantity of services provided. The Arts & Humanities in Medicine Program uses interdisciplinary perspectives and research to tackle these fundamental changes in medicine. By equally utilizing the sciences and humanities in brainstorming solutions, the program utilizes the most holistic approach to medicine. In particular, one point of emphasis is the humanity of patients: there is a unique story that underlies every case and situation. In using art to represent the pressing need to return to empathetic and genuine healthcare, I have found inspiration in the works of Wendy Red Star. Her techniques directly edit and commentate on historical photos to provide a glimpse into the lively history of still images. These additions may contrast with the visual, agree with the image, or simply add depth to the representation. In the style of Wendy Red Star, this piece reflects the otherwise unknown story behind a routine X-ray scan. The altered image reminds the audience that there is both a clinical and a personal side to every moment in medicine: both are necessary to provide the best service to patients.

618. Fo·lie à Deux

Submission Type: Exhibit

Submission Category: Arts

Author(s): Stanley Levitsky, James Winters, Julian Winters

Faculty Mentor: Susan Smith

Abstract: Energy Transfers & Conceptualism

"Energy can be transferred from one object to another or between energy stores within the same object. For example, on a pool table when white ball hits another ball energy is transferred from the kinetic store of the white ball to the kinetic store of the other ball."
There are 5 ways energy can be transferred;
▪ Mechanically - By the action of a force.
▪ Electrically - By an electrical current.
▪ By radiation - By Light waves or Sound waves.
▪ By heating - By conduction, convection or radiation.
▪ Through an artist - By Conceptualism.
▪ The car slows. The Fiat applies the brakes.
▪ Our bodies collided with the seats.
▪ We light a match.
▪ We create light.
▪ Kənˈsɛptjʊəˌlɪzəm | (noun)
▪ The philosophical theory that objects reflect the existence of some mental entity through which the application of an idea and light is mediated.
▪ Philosophically, "real difficulty appears when we assign different attributes to the thing in nature and to the thing in thought; if we hold that the one is individual and the other universal. An antinomy then arises between the world of reality and world as represented in the mind, and we are led to inquire how the general notion of flower conceived by the mind is applicable to the particular and determinate flowers of nature."
▪ All this began for me when I read that James Turrell (famous artist and theorist) believes that light knows when it is being looked at…

conceptualism
(Kənˈsɛptjʊəˌlɪzəm)
NOUN
the doctrine, intermediate between nominalism and realism, that universals exist explicitly in the mind as concepts, and implicitly in things as shared qualities
Webster's New World College Dictionary, 4th Edition. Copyright © 2010 by Houghton Mifflin

619. Placarding Painting #2

Submission Type: Exhibit

Submission Category: Arts

Author(s): Augusta Sparks Farnum

Faculty Mentor: Susan Smith

Abstract: Placarding signs are used by code enforcement to signify unsafe, or condemned buildings to firefighters across the country. The placarding signs consist of a white “X” on a red background. According to the city of Bangor’s website, the sign can only be removed when a certificate of occupancy is issued. Placarding as a word refers to non-paper signs that are more substantial than a label. The etymology references plaques that have an official seal or authentication. However, the same word, placard, references in french, a cupboard or a closet without windows, and with storage.

I have taken these placarding signs and integrated them into a series of works called, The Placarding Paintings. By repainting the actual signage by hand, I have used them in three prior showings, exploring how they affect the art that they are near. Two shows placed the placarding paintings with random paintings of similar size, by other artists or myself. As expected, the Placarding Paintings became the focal point, and held the viewer’s attention. Surprisingly, the Placarding Paintings became a resting spot, a disruption, and an entrance to see other paintings around them, intentionally.

For the symposium the painted signs are used again, this time fastened to the “outside” of a construction which houses an internal mural. The Placarding Paintings portray a directive, regardless if the code is known, and the viewer has to decide how to approach the work. Given a cupboard’s or building’s possibility for stories, the work asks about access, curiosity and permission.

620. The Snail Seller

Submission Type: Exhibit

Submission Category: Arts

Author(s): Charles Adjaye

Faculty Mentor: Susan Smith

Abstract: My art practice involves both two-dimensional and three-dimensional, employing the role of assemblage, pyrography, and relief sculptures, painting informed to create an illusion of flatness. Composing assemblage sceneries on already made wood-burning images. My typical material includes discarded or unused resources such as snail shells, aluminum foil, sacks, plastilina clay, calabashes, clothes, etc. create. My choice of these materials reflects my interest in reuse, transformation, and an intrinsic desire to create three-dimensional art on two-dimensional sceneries.
My source of inspiration is from everyday activities of the way of life of the Sub-Saharan people. I am interested in how objects allow me to investigate my culture and the significance of human activities.
Transforms simple materials into meaningful assemblages that create a distinctive visual impact.
Title- 'The Snail seller'
Medium- wood, snail shells, clay, sack, basket, charcoal, pencil, clothes, paint.
The work depicts the connection between biological species in art.
I am trying to let people know how the open market is done in Sub-Sahara and other parts of the world.
How ex-cargo is being picked or bred and sold alive.

621. SLAB Activating Art and Science

Submission Type: Exhibit

Submission Category: Arts

Author(s): Anna Martin, Alex Rose

Faculty Mentor: Susan Smith

Abstract: SLAB is a project developed through the UMAI Seed Grant:

Visual Forestry: Creating a Learning Ecology. This work is an Interdisciplinary Collaboration between University of Maine Departments of Intermedia and Forestry.

This UMaine Arts Initiative seed Grant is led by Susan Smith in collaboration with Aaron Weiskittel. This project is one of a series of Intermedia Program collaborations that situate themselves at the intersection of art and science.

“The goal of the project is to foster future collaboration, increase awareness in ecology through the arts, and create additional synergies that might lead to additional opportunities for collaboration.”

(Smith & Weiskittel: Visual Forestry Grant Proposal, 2022)

Let’s Collaborate!

SLAB (a mobile Studio Laboratory) is an interactive site featuring University of Maine Departments of Intermedia and Forest Resources. SLAB presents materials exploration and interactive technology that draw together creative strategies of engagement and Maine forest research.

SLAB is a thoughtfully designed, freestanding structure comprised of three workstations that offer various ways to discover what Maine Forestry and Creative Engagement are all about:

An interactive touchscreen featuring Maine Forest and Sustainable Materials Research.

A Printmaking workstation using natural pigment crayons, Maine Champion Tree leaf identification plates and take-away booklets.

A Cellulose Nanofibers Discovery Station: cellulose nanomaterial provided courtesy of the Process Development Center at the University of Maine. The CNF Discovery Station features scientific illustration and artworks from Intermedia MFA and Interdisciplinary Ph.D. students at the University of Maine.

622. Caught in the Crossfire

Submission Type: Exhibit

Submission Category: Arts

Author(s): Mary Kate Jones

Faculty Mentor: Susan Smith

Abstract: In the 21st century, gun violence has plagued our adolescents, from increased suicide rates involving a firearm to mass shooting events. In 2020, the CDC reported the firearm homicide rate was the highest it had been in nearly 35 years, with 79% of all homicides and 53% of all suicides involving a firearm. The media is producing news so quickly that it would be hard for anybody to process anything they're told, much less discern the truth or any bias from the news source they are meant to trust. It is a difficult time to be emotionally self-aware, and in the pandemic many turned to craft for comfort in the politically and mentally turbulent times. Art has the unique ability to make the moment participatory, preserve its memory, and function as activism. Environmental artists create art from recycled and eco-friendly materials, while others like Banksy take a stance on international gay rights, like his mural Rage, the Flower Thrower. Caught in the Crossfire deafens sound around the gun violence movement using impractical materials for everyday use to focus on what should be the most important messages: while we are human and make mistakes, something is fundamentally wrong with our willingness to accept violence. It utilizes Kevlar, an incredibly strong synthetic material used to protect the hulls of boats, and is more commonly found in bulletproof vests and combat gear. The dichotomy between a violent, protective material and an everyday item like a dress emphasizes the absurdity of some solutions offered to our gun violence problems.

623. The Role Universities Can Play in Preserving the Work of the Hand for Creative Students in a Technologically Advancing World

Submission Type: Exhibit

Submission Category: Arts

Author(s): Sarah Kizza Nsigaye

Faculty Mentor: Susan Smith

Abstract: The issue of technology versus the work of the hand is currently generating debate with critics arguing that works realized through manipulation of technology do not qualify as art because; processes, ideas and skill is what makes art. The counter argument holds that technology in itself requires skill, technique and creativity. Where these differing views are in agreement is the fact that technology is an indispensable aspect of art not only in the area of distribution and exhibition but also at the level of creation.

Leveraging on the availability of the state of the art facilities in Maine University's Innovation Research Media Center (IRMC), where students are exposed to the latest state of the art equipment, while at the same time encouraging them to work with their hands, this documentary film examines the role of technology in the arts curriculum but also recognizes the need for the work.of the hand in a University setting.

624. Illuminating Sound: A 3D Printed Violin with LED Lighting System

Submission Type: Exhibit

Submission Category: Arts

Author(s): Ruixin Niu

Faculty Mentor: Susan Smith

Abstract: Experience the intersection of music and technology with a 3D printed 5-string violin equipped with a remarkable LED lighting system. Made with transparent PLA material, this violin emits a range of colors corresponding to the notes being played, thanks to its sophisticated lighting system controlled by Raspberry Pi Pico.

The impact of this instrument and its lighting system is particularly significant for beginners learning to play a string instrument. With the visual aid signaling whether a note is in tune or not, beginners can more easily differentiate between pitches and better understand the fundamental principles of music.

Additionally, the color-coded lighting enhances the experience for audiences who are not familiar with certain kinds of music, such as Chinese pentatonic music, which features five different modes. The LED lights help to distinguish the subtle differences between modes and add a new dimension to the auditory experience.

Witness a stunning visual display as the LED lights illuminate in various colors that correspond to the notes being played. This innovative lighting system promises to revolutionize how we listen to and appreciate music by adding a new visual dimension to the auditory experience.

625. Intermedia Workshop

Submission Type: Poster

Submission Category: Arts

Author(s): Keith Hayden

Faculty Mentor: Susan Smith

Abstract: I have been developing a series of workshops which investigate conceptual and practical approaches to craftsmanship. These workshops are primarily wood carving and have, in the interdisciplinary spirit, integrated intermedial, technological and conceptual approaches to craft. The workshop setting allows both instructor and student to consider traditional approaches within a contemporary setting. This fusion of old and new worlds creates a unique space where novel approaches may be generated. These novel approaches do not simply barrel forward in the spirit of innovation for innovation's sake but rather allow the work to proceed in a more fully contextualized way. These workshops highlight the direction that I intend my research to take over the next few years. Through my research and collaborative practices over the previous years I have come to appreciate how contemporary intermedial approaches to Art and Science can be important. In the current technologically driven atmosphere of society and academia, which I say with no hostility towards technology, it is important to have people who can engage in an interdisciplinary way and act as a bridge between Arts and Science understanding both the practical factors as well as the overarching conceptual considerations. Contemporary intermedial practice has drawn from a variety of conceptual structures and approaches such as Zen, social engagement and in my case cognitive evolution. Intermedia is not simply New Media, it is an approach that is both forward and backward looking. This approach can be a powerful tool for contextualizing innovation. I would assert that innovation needs this kind of cultural and conceptual grounding.

626. Reticulating Museum Practices with Digital and Community-led Curation

Submission Type: Poster

Submission Category: Arts

Author(s): Tanja Kunz

Faculty Mentor: Susan Smith

Abstract: Reticulating museum practices with digital and community-led curation

627. V’s 70’s Mix Spotify Tarot Cards

Submission Type: Exhibit

Submission Category: Arts

Author(s): Vanessa Schaeffer

Faculty Mentor: Susan Smith

Abstract: An innovatively original Modern / Contemporary Tarot Deck made of songs from the 1970s. A typical 78-card tarot deck that includes two songs per card, one song representing the upright and reversed meaning of the card. This deck is designed in the form of A/B side of a cassette tape which includes the single's album cover and its corresponding Spotify code, allowing those who view the card to bring up on their mobile device. The visual representations shown on the Rider-Waite Smith tarot cards can be associated with song lyrics that describe themes of everyday life situations. The lyrics from the songs are conceptually correlated with the elements of Water, Earth, Fire, and Air, which describe life aspects that people will find themselves situated in visually matched on the original pictorial representations. These Minor Arcana elements can be shown in the different colors: Blue (Cups: emotions, personal connections with family or friends, and relationships), Green (Pentacles: material world, our relationship to finances, careers, property, home, and ego), Yellow (Wands: ideas, creativity, inspiration, and ambition), and Purple (Swords: mind, intellect, power, judgment, and personal beliefs), respectively, along with Red for the Major Arcana. Each of these suits contain four court cards: the Page, Knight, Queen, and King. They symbolize personality types, behavior patterns, and sometimes, actual people in your life. The remaining cards are numbered one through ten. The artist wishes the viewer to walk away with more understanding of how music can be associated with upright/reversed tarot card meanings.

628. Sun Ra and John Cage, Avant-Garde Art and Jazz

Submission Type: Poster

Submission Category: Arts

Author(s): James Winters

Faculty Mentor: Susan Smith

Abstract: The dissertation “Sun Ra & John Cage, Avant-Garde Art and Jazz,” conducted by UMaine trombonist and MFA artist James Winters, centers around one rarefied and ephemeral concert that took place only once in history on a stage in Coney Island, New York. This concert took place in 1986 yet affects music and art education today. This research qualitatively describes the backgrounds of these two avant-garde musicians during a time of classical avant-gardism.

Chapter one establishes the meaning of avant-garde, advanced guard. or vanguard work in art and music. Chapter two divides into two sections thereby establishing John Cage and 20th century classical avant gardism along with and compared to Sun Ra, a late 20 century jazz experimentation or experimentalism during this same historical period.

Chapter three addresses intermediate art through the methodology of celebrating nonevents. Chapter four describes the circumstances leading to a unique concert that combined these two already-introduced musical artists.

Chapter five looks at the concept of Conceptual art and postmodern art forms. Chapter six opens up a discussion of jazz education and the challenges of teaching experimental or expanded musical performance from an artist and an educator's perspective, including a closer look at specific points of research through orchestrated events, original compositions, correspondence, and AI artwork. Specifically, music and art students at UMaine will benefit from this research.

629. Performance, Perception and Materiality in Ecofeminism and Somatics

Submission Type: Poster

Submission Category: Arts

Author(s): Rori Smith

Faculty Mentor: Susan Smith

Abstract: My research traverses the interdisciplinary ground between art history, dance studies, feminist theory, and the philosophy of perception. Uncovering the many ways we learn to belong in the world through our bodies' relationships with their environments is at the foreground of my inquiry. In my practice as a performing artist, it interests me to be in relationship with the material that intersects my life and to ask questions about how we categorize and assign value to all that occupies the world with us. At this juncture of environment, material, and environment as material, I find inspiration in the work of ecofeminist artists and philosophers and in the discipline of somatic movement studies. One arm of my research examines the use of body as landscape by ecofeminist performance artists in dialogue with the notion of a body's inner landscape as a spatial model for interoception, which I have learned through the somatic movement practice Continuum. What we might be saying when we name our experience of interoception, the perception of the space within our bodies, as navigating an inner landscape is that we recognize something in our self-perception that is shared in our perception of the world around us. I am very interested in the implications about the experience of scale and indeterminacy within the body that are possible within this elliding of internal and external space. I argue that ecofeminist performance art and somatic practices also overlap in their desire to demonstrate the ethical, phenomenological and political dimensions of intersubjectivity.

Social Sciences and Humanities

701. This Land is Your Land and This Land is My Land': The Legacy of Colonialism in the Roman Catholic Church's Relationship with the Penobscot and Passamaquoddy Nations in the Twentieth Century

Submission Type: Exhibit

Submission Category: Social Sciences and Humanities

Author(s): Tom Pinette

Faculty Mentors: John Bear Mitchell, Paige Mitchell

Abstract: The Roman Catholic church has become an important figure in the history of the Penobscot and Passamamqoddy peoples over the past 300 years. In light of the Maine Wabanaki Truth and Reconciliation Commission (MWTRC) and the ongoing Residential School crisis for First Nations in Canada, the Catholic church's complex involvement in the colonization and assimilation of Wabanaki peoples has come under scrutiny and study. This historical project seeks to analyze how the relationship between these two entities has changed in the past 120 years, with specific attention given to instances of conflict or tension. The thesis of the project is that the Portland Diocese has, and continues to, assume a paternal and missionary stance in its presence in the individual and tribal lives of the Penobscot and Passamaquoddy nations, which has caused the centuries-old tradition of syncretic Catholicism in Wabanaki life to be dismissed by the resurgence of Indigenous pride and sovereignty in Maine during the twentieth century. Using decades of archival documents and ethnographic interviews with citizens of these two Wabanaki nations, this project reinterprets the local and global implications of the Catholic church's involvement in Penobscot and Passamaquoddy spiritual, cultural, and political life through the lens of clericalism and postcolonialism. This project characterizes the general nature of what I refer to as 'Wabanaki Sycretism', while employing the theological and socio-political components of this unique religious expression to interrogate recent historical movements within white settler societies, like Christian missionization, cultural genocide in America, and understandings of whiteness.

702. Citizen Preferences for Addressing PFAS: Factors Affecting Willingness to Contribute

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Charity Zimmerman, Molly Shea

Faculty Mentor: Caroline Noblet

Abstract: Per-and polyfluoroalkyl substances (PFAS) are a novel environmental contaminant of particular importance in Maine. While there is a substantial body of literature investigating factors affecting citizen willingness to finance policies that address various environmental issues, the emerging PFAS threat has yet to be thoroughly investigated. In this research, we ask two key questions that investigate Mainers' willingness to contribute towards programs that may fund PFAS prevention and mitigation: Is how we talk about sources of PFAS and how we ask for contributions important in making contribution choices? To investigate this, we designed and administered a mixed mode survey to a random sample of Mainers. To answer our first question participants were assigned one of two message frames about potential sources of PFAS (industrial or consumer) or a control condition. To answer our second question, the survey presented two potential mechanisms for citizen payment to PFAS mitigation efforts: an increase in annual property taxes or a sales tax on certain products that contain PFAS. Preliminary results suggest that 66% of respondents indicated a willingness to contribute towards a program to address PFAS in Maine. Our results indicate that how we talk about PFAS matters, as there were differential impacts on willingness to contribute dependent on the message treatment shown. However, the impact of payment mechanism may be limited and dependent upon respondent profiles. While it is evident that Maine citizens are willing to support programs addressing PFAS contamination, it is important to continue to improve our understanding of citizens' evolving preferences.

703. Mutual Aid: A Community-led Solution to Economic Hardships at the University of Maine

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Tamra Benson

Faculty Mentor: Robert Glover

Abstract: Economic inequality and hardships are common issues on college campuses, for both students and employees. Mutual aid is the act of giving and receiving aid within a community where those who have extra resources may give to those who lack them, with the goal of building community care and resilience in the face of hardships. Many college campuses have established mutual aid funds to provide a safety net for those who are left behind by standard aid programs. These funds can have several structures, so conducting research is essential before deciding on a model. The goal of this project was to design a template for the implementation of a mutual aid fund at the University of Maine.

The research included a literature review of the methods of effective mutual aid funds. A survey with over 300 respondents was conducted to investigate the financial hardships of members of the UMaine community, how likely they might be to use a mutual aid fund, and how we can make the fund as accessible as possible for all members of the community. A majority of survey respondents had not heard of mutual aid before taking the survey, but 66% say they would likely use a mutual aid fund on campus in times of need. Interviews were conducted with leaders from within the University community to supplement the data from the survey. This information was used to design a template for a mutual aid fund that is the best fit for the University of Maine.

704. Association Between COVID-19 Coping Strategies and Cognitive Function in Older Adults

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Morgan Tallman, Holly Timblin, Rebecca MacAulay

Faculty Mentor: Rebecca MacAulay

Abstract: Coping encompasses varying processes used to manage stress, which is important as chronic stress can have long-term effects on mental and physical health. Cognitive function may contribute to older adults' use of coping strategies to manage pandemic-related stress. Critically, with Maine's high population of older adults, it is essential to understand how older Mainer's cope to develop avenue's of support. This study aimed to determine whether Approach and Avoidant coping strategies were associated with cognitive function. Community-dwelling older adults (n = 141, 75% female, Mage = 72) completed the study via Zoom. Cognitive function was assessed across four domains: working memory, verbal memory, executive attention, and verbal fluency. The Brief Cope, adapted to evaluate COVID-19, measured 14 specific coping strategies. Based on our factor analyses, Approach (e.g., instrumental support systems and planning) and Avoidant (e.g., substance use and denial) coping composite scores were formed. Regression analyses, adjusted for age and education, indicated that 9.1% of the variance in Approach coping strategies was related to cognitive function, with working memory and verbal fluency being statistically significant contributors to the model. 12.9% of the variance in the use of Avoidance coping strategies was explained by worse performance on measures of verbal memory and executive attention, and working memory. These results suggest older adults with lower cognitive resources may benefit from brief interventions to facilitate problem-solving and reduce emotional distress. With more effective coping, we may be able to alleviate some of the negative effects chronic stress has on health.

705. The Effects of Messaging Framing on Citizen Support for the Aquaculture Industry

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Alissa Miller-Gonzalez, Laura Rickard

Faculty Mentor: Caroline Noblet

Abstract: Aquaculture, the farming of aquatic animals for consumption, is an industry that has one of the largest potentials for growth in the U.S. compared to other countries (Kapetsky et al., 2013). The aquaculture industry in Maine employs over 1,000 people and contributes over $130 million to the economy annually (Cole et. al., 2017). At a time when fisheries are facing pressures from both climate change and the COVID-19 pandemic, growth of the aquaculture industry has the potential to support both Maine’s economy and its residents (Fernandez et. al, 2020).

While others have studied consumer attitudes towards aquaculture seafood, little is known about how messages emphasizing the benefits of aquaculture expansion might influence citizens’ attitudes and behaviors. The purpose of this study is to advance our understanding of how using different message frames can influence peoples’ levels of support for the industry. We explore the effects of messages that provide information on promoting gains, averting losses, associating aquaculture with the status quo, and changing status quo frames on citizen support for aquaculture. Results show that averting loss and the change treatments positively affected support in both Maine and the U.S. while the promoting gains and status quo treatments positively affected support only in Maine. Further, perceived risk and benefit both mediate the relationship between message frame and support for aquaculture. These results may provide guidance to the aquaculture industry and the State of Maine regarding methods to communicate information about the industry to the public to increase support.

706. Conceptualizing and Enacting Gender Euphoria: Exploring Awareness and Action Across Gender Demographics

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Willow Wind

Faculty Mentor: Liliana Herakova

Abstract: Our society needs to talk about gender, but we aren't very good at it. Avoiding these discussions has harmful impacts on body image and various health disparities (The Trevor Project, 2020). What if we have better and regular conversations about ways we can positively experience gender? This study's model of negotiating gender can be used by families and educators seeking affirming exploratory learning opportunities. Insights into meanings of gender euphoria help validate diverse sets of experiences, informing a broader cultural discourse that increasingly questions gender binarism (Griffin, 2020).

This study explores conceptualizations and enactment of gender euphoria across demographics and contexts. Gender euphoria, one's sense of gender belonging and fulfillment, offers a resistive approach to pathologizing gender (Benestad, 2010). Understanding gender as socially constructed communicative performances, 27 individuals were interviewed, including 9 healthcare professionals. Analysis followed a qualitative grounded theory approach, with findings offering healthcare and mundane practices for discussing gender.

Results show that patients and providers generally view gender as non-medically relevant, despite participants valuing negotiating gender in healthcare. Thus, gender is erased in clinical interactions, possibly believed to be a "self-managed" aspect of health. The disconnect between desired conversations and perceived relevance highlights a need for general healthcare to be reframed in terms of wellness, not only illness or crisis. Relatedly, in everyday life, participants' conceptualization of gender euphoria was informed by self-exploration and exposure to non-mainstream histories and identities. It referred to their sense of autonomy, alignment, and affirmation, encapsulating both episodic experiences and states of being.

707. Associations Among Education Level, Cognitive Performance and Depressive Symptoms

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Sean Carey

Faculty Mentor: Michael Robbins

Abstract: A decline in cognitive performance is often observed as one ages, however there are protective factors that can slow this decline. One of these protective factors is a high level of education, which provides cognitive reserve, and the maintaining of higher levels of cognitive performance in older individuals. In general though, in addition to a decline in cognitive performance, older individuals are also at a higher risk for exhibiting depressive symptoms. This study will be looking at the association of depressive symptoms and cognitive performance for cohorts of lower educated individuals and higher educated individuals. It is hypothesized that individuals with higher levels of education will show higher cognitive performance as well as lower levels of depressive symptoms. Further we hypothesize that higher levels of education are protective of cognitive performance in relation to symptoms of depression. This study will use the Maine-Syracuse Longitudinal Study (MSLS) data archive, which contains valuable information about aging individuals gathered over seven longitudinal waves. Initial statistical analyses from wave 6 of the MSLS for participants over the age of 50 show: 1) a positive correlation between education level and global cognitive composite scores; 2) negative correlations between education level and symptoms of depression using CESD scores and Zung depression scale scores; and 3) indications that symptoms of depression do not correlate as strongly with cognitive performance for the cohort with higher education levels. Further analyses will include specific cognitive domains, and covariates such as sex, social activity, psychotropic medication, and marital status.

708. Transportation Choices and Available Options for Households in Piscataquis and Penobscot Counties

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): George Akandinge, Kathryn Grond

Faculty Mentor: Jonathan Rubin

Abstract: Access to critical services, such as jobs, education, healthcare, and shopping, is essential for the livability of any community. For those living in rural communities, these services are often farther away, requiring access to a vehicle or public transit. Maine is the state with the oldest median age (44.7) in the United States, and is the second most rural state, with a proportion of rural residents of 61.4% in 2020, according to the US Census Bureau. Combined with harsh winters and complex coastal peninsulas, Maine's aging and low-density communities are facing transportation challenges, including rising gas prices and the lack of public transit drivers. This research explores the transportation options that are available to residents in the two counties including private vehicle, public transit, paratransit, active transportation, limited on-demand services, and ride-hailing companies. This research uses survey responses from households to study the typical daily travel for work, education, shopping, and other activities, their experience using public transportation, challenges in getting to where they want to go, as well as changes in commuting and employment during the first two years of COVID pandemic. The findings from this will be helpful to state and local governments and policy makers more generally to better understand the transportation need of the two counties. The Eastern Maine Development Corporation (EMDC) aims to support community economic development by addressing the transportation barriers that residents of small communities and rural areas in Maine face when trying to access services, healthy food, and employment based on the findings from this study.

709. Revisiting Stylistic Research Paradigms of the Passamaquoddy Petroglyphs in Eastern Maine

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Deirdre McGrath

Faculty Mentor: Bonnie Newsom

Abstract: Petroglyphs are amongst the oldest forms of visual material culture in what is now known as Maine. These images, some of which are 3,000 years old, were expertly created by ancestral Passamaquoddy artisans who methodically removed flakes of stone from coastal and riverine shoreline bedrock. Due to the shoreline location of these petroglyphs, they are at risk of damage and loss due to climate change-induced sea level rise in the Gulf of Maine. While sea level rise is a cause for concern in preserving, documenting, and interpreting the petroglyphs, there is an additional challenge. Petroglyph images are routinely analyzed and categorized using standardized stylistic rubrics, which as a research practice freeze the interpretation and meaning of these images in the distant past. While the reason for creating the petroglyphs is known only to Wabanaki Ancestors, static interpretations serve less of a purpose to contemporary descendent communities who interact with these petroglyphs in multifaceted ways. Therefore, we conducted a pilot project designed to apply a new decolonized stylistic analysis to a sample of petroglyph images and make these new data available to the Passamaquoddy Tribal Historic Preservation Office. This process included methods of collaboration and guidance from Etuaptmumk (Mi'kmaq: “Two-Eyed Seeing”), where both Indigenous and Western knowledge production modalities work together to create a holistic set of knowledge(s). While this pilot project was a small attempt to bring a more dynamic interpretation to petroglyph research paradigms in Maine, it relates to the big picture of decolonizing archaeological research practices.

710. The Future is Coming, But We're Not Exactly Sure When Yet

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Cat Sabourin

Faculty Mentor: Elizabeth Depoy

Abstract: Social work is a diverse and evolving profession, which theoretically and in varied practice arenas, relies on what we refer to as the "being there" methods for promoting social change. (e.g. relationships, narrative therapy, and interactions). Although present in organizational contexts and potentially complementary to professional outcomes, education, intelligent tools have not been widely embraced to enhance and expand practice outcomes.

A growing literature has recognized the ubiquity of artificial intelligence and thus the critical need for social work to integrate these contemporary tools throughout the diversity of professional practice. Even with some reticence to adopt this technology, it is both necessary and opportune for professional survival and ability to continue essential work. Thus the field must stay current and collaborative in its knowledge, research, education, and practices. Integrating disability studies, social work, and contemporary artificial intelligence methods, this paper investigates, illustrates, and evaluates a model of practice in which an intelligent AI robotic companion is used to further amplify and extend social work intervention for the purposes of 1. decreasing isolation and loneliness in adults residing alone in diverse rural to urban communities and 2. reducing institutionalization.

Methods
An extant data set from a statewide initiative in NY provides the data for analysis to evaluate the social, mental health, cognitive and eudemonic outcomes of incorporating AI into practice. Analysis will point to practice futures, research directions and educational implications for the field.

711. Thinking and Designing Beyond the Jig - Seating Reimagined

Submission Type: Poster

Submission Category: Social Sciences & Humanities

Author(s): Lily Watson

Faculty Mentor: Stephen Gilson

Abstract: Most chairs aren't designed to serve human bodies.
Sitting is a fundamental human activity, occurring for many purposes, within diverse contexts including but not limited to rest, conversation, eating, listening, consuming culture, learning, navigation, among many others. Curiously, contemporary seating in public spaces, adheres to standard chair design, "Seats are typically required to be between 16 to 20 inches (40.6 cm – 50.8 cm) tall and at least 18 inches (45.7 cm) deep. If backs are present on the seats, they typically are at least 14 inches (35.5 cm) high. If the seat has armrests, they should support the arms without raising the shoulders (https://www.dimensions.com/collection/chairs-seats).

Enter, the impaired body, not simply as source for treatment and revision but as a challenge to standard design and impetus for innovation and creative redesign. Combined with disjuncture theory, a contemporary approach to understanding disability as inability to complete a task, and the design adage of design for the extremes, this poster presents an innovative chair redesign project. The effort was intended to enhance comfort and functionality as well as aesthetics of seating in public spaces. The poster content synthesizes the scholarly rationale and redesign principles used to craft a design for flexible seating at a table, illustrates the redesign of chairs and tables. The work then proceeds to forensically analyze the redesign to highlight what yet needs to be done to advance seating design for the full diversity of seated bodies.

712. Mood Differences Following Dyadic Friend Conversation in Male and Female Adolescents

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Jennifer Hugg, Daniella Gelman

Faculty Mentor: Cynthia Erdley

Abstract: “Overcontrolled” people often experience excessive inhibitory control, high threat sensitivity, and have aloof or distant relationships. The present study examined whether the Match +1 skill from Radically Open Dialectical Behavior Therapy is effective in improving social connectedness and mood in a sample of adolescents during a brief intervention. The sample included 106 college students (56 female, Mage = 19.54 years, 87.7% White). Same-gender, already acquainted dyad members participated in a Zoom call with the option to use conversation prompts. Dyads were assigned to the Match +1 condition (prompts to promote social connectedness) or control condition (neutral prompts). Pre-conversation, participants rated their overcontrol, relationship quality, social connectedness, and mood. Post-conversation, they again evaluated social connectedness and mood. Although there was no significant Condition X Overcontrol interaction on social connectedness or mood, quality of relationship support positively predicted social connectedness post-conversation ($p < 0.001$). This suggests those with higher quality relationships are especially likely to benefit from further relationship enhancement strategies. For females, those with higher relationship support reported more positive mood ($p < .002$) and less negative mood ($p < .01$) post-conversation. These findings indicate that while both male and female adolescents with high relationship support experience enhanced social connectedness post-conversation, females additionally report increased positive mood and decreased negative mood. Perhaps females experience mood-related benefits post-conversation because females expect more relational intimacy, and when feeling greater social connectedness, this enhances mood. Males may not value social connection to the same degree, so enhancement may not have equivalent impact on emotional experience.

713. Family Member Perceptions of Radicalization in Homegrown Violent Extremists

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Brooklyn Buxton

Faculty Mentor: Karyn Sporer

Abstract: This research examines the presence of nonideological risk factors (e.g., adverse childhood experiences, conduct problems, mental health issues) in homegrown violent extremists (HVE), as well as the signs of radicalization observed and interpreted by family members. Data from in-depth life-history interviews with twelve family members of HVE were analyzed using focused coding and content analysis. The data analysis revealed high rates of non-ideological risk factors compared to the general population. The findings also showed that while family members often observed warning signs of radicalization, these behaviors were often ignored or misunderstood. The findings in this poster presentation are organized into four primary themes: (1) nonideological risk factors present in HVE, (2) family members' observed warning signs of radicalization, (3) family members' interpretation of these observations, and (4) family members' responses to warning signs. The research concludes with recommendations for mental health practitioners and countering violent extremism agencies in how we can (a) support family members of HVE and (b) inform programs aimed at preventing or mitigating violent radicalization.

714. Determinants of Maine Substance Use Recovery

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Michael Delorge

Faculty Mentor: Robert Glover

Abstract: While Maine overdose deaths have quadrupled over the past decade, 93% of overdoses in Maine were nonfatal in 2022, suggesting the wider prevalence of substance use disorder (SUD). Despite the copious research on SUD, minimal research has been done to understand the factors that contribute to success in long-term substance use recovery or the lack thereof. This study analyzes the data set gathered from the unpublished University of Maine 2022 Life in Recovery in Maine (LIRIM) survey which collected quantitative and qualitative experiences of Mainers in long-term substance use recovery. This study is the first to quantify recovery experiences on a statewide level while using LIRIM data to analyze recovery outcomes as a function of different demographic dimensions. How do the prevalent hypotheses of geographic proximity to treatment resources and a greater sense of community belonging contribute to success in substance use recovery? These questions are examined through index design to quantify recovery experiences and multivariate regression analysis to test the statistical significance of these models. The results can inform public policy, by providing decision-makers guidance on where to allocate resources for addressing SUD on a statewide level, also while providing researchers a blueprint for future determinants-based research on substance use recovery outcomes.

715. Sleep and Taupathies: An Application of the PRISMA Method for a Systematic Review

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Jennifer Thompson, Sophia Lambert, Jacob Tucker

Faculty Mentor: Fayeza Ahmed

Abstract: This project highlights a systematic review investigating the relation between sleep and tauopathies (a disease which reflects the pathological changes in the brain's tau protein). Examples include primarily aging disorders and dementias, including Lewy body dementia, Alzhiemer's disease, and progressive supranuclear palsy (Leuzy et al., 2019; Williams, 2006). Sleep is a behavioral modifiable risk factor that has been implicated in many of these disorders, but the process, relationship, and mechanisms are still largely unknown. This project aims to identify a gap in the literature concerning sleep behaviors and patterns within tauopathies. Understanding relationships between behaviors and disease pathology is crucial to furthering our understanding of causes of disorders, ast there are no known cures for neurodegenerative tauopathies.

This process will involve registering the project with Prospero, a database of potential systematic reviews and meta-analyses. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, this project will include identifying a specific research question with inclusion and exclusion criteria for study comparison, including populations, disease, and techniques (such as imaging, sleep methodology, and biomarkers). Key terms will be identified to use through academic databases.

The literature search to begin the systematic review can occur after Prospero application approval. The primary outcome of this project is to produce a paper to submit for publication in an academic neuropsychological or related-field (sleep, aging, dementia) journal. Further, this review can help differentiate sleep in tauopathies to promote and inform future research of risk factors and behavioral interventions. The poster will describe the PRISMA method, which allows for reproducible literature searches via this standardized method.

716. Transdisciplinary Collaboration and Partner Engagement in the Maine-eDNA Project

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Jennifer Smith-Mayo, Heather Leslie

Faculty Mentor: Bridie McGreavy

Abstract: Transdisciplinarity is understood as shared knowledge production by researchers and other community members that connects with societal challenges. As engaged communication and team science researchers with the Maine-eDNA (environmental DNA) project, we study how communication shapes transdisciplinary collaboration. Our participatory research approach helps us learn about communication practices within Maine-eDNA, a multi-institutional project engaging with dozens of community, government, and private sector partners within and beyond Maine. Using an engaged and ethnographic research design, we developed a communication survey administered to project participants (n = 78, 68% response rate) in Fall 2021. This survey is one of multiple qualitative and quantitative methods we use to study and help shape communication practices. The survey instrument design was informed by semi-formal team science interviews (n=15) we conducted in Fall 2020 with Maine-eDNA participants and ongoing participant observations in the project. Our primary research question asks how specific communication elements shape our eDNA-focused transdisciplinary collaboration. In the analysis, we identified descriptive and inferential patterns that help us understand the diversity of ways in which communication shapes this team science collaboration. For example, participants identified diverse motivations that shape how they communicate across disciplines and with community partners. These communication-focused motivations include how participants enjoy learning from others (72% strong agreement), they are interested in ethical responsibilities of researchers (51% strong agreement), and that partners have on-the-ground knowledge (62% strong agreement). Focusing on communication and motivations matters because these articulations help constitute interdisciplinary and transdisciplinary capacities for engaging in knowledge co-production.

717. Religious Self-Identity and Racism

Submission Type: Exhibit

Submission Category: Social Sciences and Humanities

Author(s): Alexandria Morgan

Faculty Mentor: Jordan LaBouff

Abstract: Several studies have examined the relationship between white American Christian social identity and prejudice toward Black Americans. In an experimental study of white Christians in the US (N = 486), we disentangle these identity components to investigate which predict racism. We find that although a greater religious self-concept ("being a Christian is important to who I am") predicts greater prejudice towards Black Americans, that relationship disappears when controlling for the effects of political conservatism or Christian nationalism. We find that the American Christian self-concept ("being an American Christian") and Christian nationalism ("America should be declared a Christian nation") are the strongest predictors of racism. Asking participants to reflect on their identities as Christians, Americans, or Christian Americans had no significant impact on their expressed attitudes toward Black Americans. These findings suggest that white Christian nationalism is an extremely powerful predictor of racist attitudes, even when controlling for the effects of religious self-concept.

718. The Relations among Emotion Regulation Difficulties, Self-Efficacy, and Anxiety in College Students

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Daniella Gelman

Faculty Mentor: Cynthia Erdley

Abstract: This study investigated the role of self-efficacy in the relationship between emotion regulation difficulties and anxiety in late adolescents. Emotion regulation (ER) has been identified as an important variable in various psychological disorders (Gratz & Roemer, 2004). Those with anxiety disorders are not as aware of their emotions and have difficulty with identifying and regulating their emotions (Werner et al., 2011). However, it is possible that those with poorer ER skills may be protected from anxiety if they have higher levels of self-efficacy. In this study, the relationships among ER, self-efficacy, and anxiety were examined in late adolescents. Participants included 350 college students (Mage = 19.11 years, 59.1% males, 96.3% white) who responded to measures assessing difficulties in ER (The Difficulty in Emotion Regulation Scale), generalized anxiety (Generalized Anxiety Disorder-7), and self-efficacy (General Self-Efficacy Scale). Results indicated that ER difficulties were correlated negatively with self-efficacy ($r = -0.47$, $p < 0.01$) and positively with generalized anxiety ($r = 0.67$, $p < 0.01$). Further, generalized anxiety and self-efficacy were negatively correlated ($r = -0.27$, $p < 0.01$). A moderation analysis indicated that there was a strong relationship between ER difficulties and generalized anxiety ($p < 0.01$). However, self-efficacy did not have an effect on the relationship between ER difficulties and generalized anxiety ($p = 0.13$). Thus, it appears that those with ER difficulties are at greater risk for anxiety, regardless of their level of self-efficacy. This suggests that interventions designed to reduce anxiety should focus on building adaptive ER skills.

719. Games as Tools for Reasoning in Transformative Decision

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Drew Parent

Faculty Mentor: Robby Finley

Abstract: Some of the most important decisions in our lives are what philosophers call transformative decisions: decisions where the outcomes not only reveal new information about what relevant experiences are like, but also radically change our identities and values. Choosing to have a child is like this, since until you have a child you cannot truly know what being a new parent will be like and how your identity and values will change. Given the weight of these decisions, it would be best to act rationally by gathering as much information as possible and choosing what seems to best align with our values, but L.A. Paul has argued in her book Transformative Experience that one cannot act rationally in these cases. Since I cannot know what the relevant outcomes will be like and how my values will change, I cannot make a choice by picking the option I expect to be the most valuable. In contrast, we argue that games can provide information that allows us to rationally approach transformative decisions. To defend this point, we use recent work by C. Thi Nguyen, who argues in Games: Agency as Art that games are tools for communicating modes of agency: a set of goals and methods of achieving those goals that characterize ways of making decisions. By adopting new modes of agency in playing games, we can access information about ourselves and what it would be like to have different preferences that can help us rationalize our transformative decisions.

720. The Effect of Physical Activity on Executive Functioning in Healthy Middle Aged Adults: Genetic Risk Carriers of Alzheimer's Disease vs Non Carriers

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Lindsey Lagerstrom

Faculty Mentor: Fayeza Ahmed

Abstract:

Objective: Physical activity level can significantly impact executive functioning, the mental process that includes working memory, flexible thinking, and self-regulation, even in healthy middle-aged adults1. Apolipoprotein e4 (APOE e4) gene status has the strongest genetic impact on the most common type of Alzheimer's Disease (AD)2. Methylenetetrahydrofolate (MTHFR) a well-established gene for increased risk of cardiovascular disease through higher levels of homocysteine, and subsequently AD3. Healthy middle-aged adults who have genetic risk factors for Alzheimer's disease, such as MTHFR and/or APOE e4, can benefit more from physical activity than non-carriers.4,5 This study uniquely aimed to study healthy middle-aged adult individuals to determine if there is already an association between physical activity level and executive functioning and if that effect can be further stratified by genetic status.

Method: Forty-eight healthy middle-aged community participants were recruited from the greater Bangor, ME area. Physical activity level was calculated by utilizing the 2011 Compendium of Physical Activities and participants were categorized into light, moderate, or vigorous activity levels. Executive functioning was captured through a Stroop Color Word score. Participants' genetic data was processed by Dr. Gareth Howell's lab at the Jackson Laboratories . This is a smaller sample due the utilization of a subset of data in an ongoing study by the principal investigator, Dr. Fayeza Ahmed at the Maine Health, Aging, and Lifestyle Lab at the University of Maine.

Results: Data collection and analysis is ongoing.

721. All Are Cordially Invited': Suffrage Activism and Exclusion in Maine, 1900-1925

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Mackenzie Reynolds

Faculty Mentor: Kara Peruccio

Abstract: During the early twentieth century, the fight for women's suffrage dominated the upper-middle class social landscape. Across the United States, national suffrage organizations set up auxiliaries at the state level to further the cause and promote grassroots campaigning for the vote. While much is known about the white women who organized letter-writing campaigns and marched in city streets, the popular narrative pointedly ignores immigrant, Black, and indigenous women. My project explores the tensions and divisions amongst Maine women between 1900-1925 in order to understand who was included and excluded from first-wave feminism. I conducted archival research in the Special Collections at Fogler Library using the Isabel W. Greenwood Papers Collection, specifically seeking out the *Women's Journal* publication circulated by the National American Woman Suffrage Association, in addition to other primary and secondary sources. For my research, I bring an intersectional feminist lens and critically read archival documents with knowledge of broader state and national political trends of the time. In my research with the primary sources, the overwhelming narrative centered around white, middle-class women in Maine's larger cities (Portland, Bangor, Augusta, etc.). By contrast, immigrant, Black, and indigenous women were mentioned sporadically and when discussed, they faced racist and xenophobic biases. While many national groups barred women of color from attending meetings or participating in the movement altogether, the situation in Maine was more complex. In the Penobscot Nation, indigenous pro- and anti-suffragists divided the north and south sides of Indian Island, and its conservative leadership opposed it.

722. Assessing Adolescent Suicidal Thoughts and Behaviors: A Systematic Review and Psychometric Analysis

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Caroline Kelberman, Eleanor Schuttenberg, Ellie Berez, Kelsey Bridges, Autumn Chadburn, Ava Goraj, Hunter Landry, Douglas Nangle

Faculty Mentor: Douglas Nangle

Abstract: Suicidal thoughts and behaviors (STBs) among adolescents are a significant public health concern. Indeed, suicide rates among adolescents have risen by 57% in the past 10 years (O'Connor, 2020). STB assessment within clinical research and practice has been a longstanding challenge. In a recent meta-analysis, no consensus was found regarding a gold standard for STB assessment among adults (Andreotti et al., 2020). Developmental considerations only add to the complexity of assessing STBs among adolescents (Spears et al., 2023). The proposed study is a comprehensive systematic review of the adolescent STB literature targeting assessment approaches and their psychometric properties. In the initial phase, a search algorithm was applied across five databases and yielded 71,535 articles. In the next phase, duplicate articles will be removed, and the following inclusion criteria will be applied: (1) original research in a peer-reviewed journal, (2) sample included adolescents between 12-17 years old, and (3) suicidality assessed using a measure that produces a suicide-specific score. The following exclusion criteria will also be applied: (1) suicidality assessed using one question or as part of a non-suicide specific measure, (2) focus limited to self-injury or other aspects of suicidality, (3) samples limited to children under 12 or adults over 17 years old, (4) literature reviews and meta-analyses, and (5) animal research. Articles meeting these criteria will be summarized along with an analysis of reported psychometric properties (i.e., reliability, validity, sensitivity, and specificity). To our knowledge, there have been no systematic reviews or analyses on this topic to date.

723. An Aristotelian Defense of the Nature of Musical Works

Submission Type: Exhibit

Submission Category: Social Sciences and Humanities

Author(s): Simon St. Pierre

Faculty Mentor: Robby Finley

Abstract: Consider an example of a musical piece: "Flood" by Snarky Puppy. Like everyday objects, e.g. tables and chairs, "Flood" is something we can perceive and interact with, but unlike everyday objects, it is also repeatable and non-physical: different performances can all count as instances of "Flood", but "Flood" itself is not identical to any of those physical performances. These odd features of musical pieces prompt the question: what sort of things are they? Philosopher Julian Dodd argues in his recent book "Works of Music" that musical pieces are abstract types whose tokens are datable, locatable patterns of sounds, a view he calls musical Platonism. On this view, Flood is an unchanging, eternal, and unstructured entity that describes the conditions a pattern of sounds must meet to count as a performance. Further, "Flood" was discovered, not created, by its composer. In contrast to Dodd's Platonism, we outline and defend an Aristotelian account of musical pieces, under which pieces are inextricably tied to their performances, do not exist independently of them, and are not eternal, unstructured types. By interpreting and applying Aristotle's view that objects are a combination of matter and form (his hylomorphism) to musical pieces as abstract artifacts, we argue that the resulting view better captures the ways musicians think about how performances are composed and change over time, better aligns with our intuition that musical pieces have parts, and provides a more naturalistic picture of musical pieces that can still explain their odd features.

724. Commonalities Among and Generational Prevalence of Russian Second Locative Nouns

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Bill Hartt

Faculty Mentor: Zachary Ludington

Abstract: The Russian language utilizes a number of grammatical case endings to indicate the role of nouns and adjectives in a sentence or phrase. Throughout their history, the case endings have merged as the sounds of the language have changed, with the exception of the locative case, which has resisted merger the most of any Old Russian case ending. It persists in a set of about 150 modern Russian nouns. This project aims at analyzing the qualitative characteristics which these nouns have in common, with an emphasis on their semantic connections. The project reviews existing literature, which has articulated shared grammatical features, some shared syntactic and morphological connections, and a few common semantic spaces occupied by these nouns. Present analysis of texts in the Russian National Corpus seeks to understand whether these nouns were resistant to other changes, such as the hypothesis that these nouns assume the prepositions associated with the case in question far less frequently than the other words in the language, possibly due to their meaning being inherent or easily discernible. Additionally, this project includes a survey, currently in development, to determine the generational prevalence of this phenomenon, and whether or not it seems to be disappearing. The goal of this research is to better understand how grammatical changes in the Russian language occur, as well as to better explain the irregularities of the language, which can prove especially difficult for learners.

Natural Sciences

801. Climate Change Effects on an Invasive Tunicate's Attachment Ability

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Rachael Smith

Faculty Mentor: Brian Beal

Abstract: The pancake batter, colonial tunicate, Didemnum vexillum, is invasive in Maine's coastal waters, and has negative effects on shellfish aquaculture. The sea squirt displays different methods of colony establishment including fragmentation. This, and high growth rates, allows colonies to quickly establish and smother benthic organisms. Gulf of Maine seawater temperatures have risen and become more acidic over the past 40 years. This study investigated how future climate change projections affect D. vexillum fragment attachment ability. Tunicates were collected from shallow subtidal near the Downeast Institute, Beals, Maine in July 2022. Four treatments (a = two temperatures; b = two pH levels; n = 3) were chosen to reflect present day and future climate scenarios. The fragments were placed in tanks on petri dishes for 24 hours, afterward two tests were performed determining how well they were attached. Expected results include differences in fragment's attachment level between projected future and present day climate conditions.

802. Snow Properties and Observations on the Quintino Sella and Seward Glaciers, Kluane National Park & Reserve, Yukon Territory, Canada

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mikaila Mannello, Jonathan Maurer

Faculty Mentor: Seth Campbell

Abstract: We collected four transects of 400 MHz ground-penetrating radar (GPR) along the Quintino Sella Glacier, Yukon Territory, Canada in May of 2022. At nine snow sampling sites across an almost 1200 m elevational distribution, we collected short (8-10 m) transects to calculate in-situ radiowave velocity, constraining depth calculations. Preliminary results include the depth to glacier ice ranging between 30 to 5 meters below the surface. We observed no elevational or temporal trend in the relative permittivity determined from ground-truth observations, with the average relative permittivity of 1.37 ($v = 0.256$ m/ns). The previous summer's ablation horizon was difficult to identify due to the inability to distinguish this horizon from other ice or snow layers within the stratigraphic profile imaged by GPR. Therefore, estimates of the snow water equivalent (SWE) of the 2021-22 water year are an area of continued work and still uncertain. Future surveying recommendations include collecting continuous GPR transects across the equilibrium line altitude (ELA) to identify an unconformity between the AA and layers below, as well as collecting multi-offset radar to provide an alternative measurement of radiowave velocities within the snowpack and firn which can improve our confidence in relative permittivity estimates.

803. Taxonomic components and infectiousness of bacteria causing potato blackleg and soft rot in the northeastern US

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Xiuyan Zhang, Tongling Ge**,** Xiaowei Fan**,** Robert P. Larkin**,** Bee K. Chim**,** Steven B. Johnson

Faculty Mentor: Jianjun Hao

Abstract: Potato blackleg and soft rot (PBSR) is caused by Dickeya and Pectobacterium spp., which related to the 2015 outbreak in the northeastern region of the US. To understand the epidemiology of PBSR, the taxonomy of the pathogens present after the outbreak and the dynamics of infectiousness throughout the tuber storage period were determined. Bacteria were isolated from potato samples showing PBSR from 2019 to 2022 in the northeastern region, especially Maine. Multi-locus sequence analysis was performed using the recA, gapA and dnaX genes of isolates' DNA. Results showed that D. dianthicola and P. parmentieri were isolated at a lower percentage than other Pectobacterium species in the outbreak. Pectobacterium versatile was more frequently isolated than Dickeya or other Pectobacterium species, and P. brasiliense and P. parvum isolates were found. To examine the infection process, 'Lamoka' potato tubers were inoculated with D. dianthicola isolate at three different time points from December to May. The inoculated tubers were grouped in storage either as 100% infested or 50% infested (mixed with 50% un-inoculated tubers). Following storage, the tubers were planted in the field. Results showed that plant emergence and yield were negatively correlated with disease intensity. The earlier the tuber was inoculated, the higher the disease level was observed. In addition, healthy tubers could be infected by contacting the inoculated tubers in storage.

804. Evaluation of Public Policy and Covid-19 Pandemic Impacts on Historic Asian Pollution Emissions Using Alaskan Ice Core Lead Data

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Hanna Brooks

Faculty Mentor: Karl Kreutz

Abstract: The North Pacific region (Alaska, USA; Kamchatka Peninsula, Russia) contains the largest amount of non-polar ice in the world, most of which has seen substantial melting due to modern climate changes. This region is of particular interest when examining historical trends in pollutants because its position uniquely links the Asian and North American continents. Winds travel west to Begguya (Mt. Hunter), Alaska, carrying dust and pollution from Asia across the North Pacific. Critical changes in culture (industrialization, Covid-19 pandemic), technology, and policy, legislation has a direct impact on pollution transported to and deposited at Begguya.

I will present Pb values from 340 to 2022 CE using ice cores from Begguya. My research aims to address three questions: (1) how have the dominant Pb emission sources evolved through the pre-industrial period, Industrial Revolution, late 20th century, and 21st century?, (2) did the magnitude of Pb deposition decrease concurrent with lockdowns during the Covid-19 pandemic?, and (3) what Pb sources were impacted the longest by Asian Covid-19 lockdowns? My preliminary Pb analysis shows a slow positive increase in Pb excess from 800 until ~1850 CE, when values begin to rapidly increase with Asian industrialization. This trend is also found in other studies of the North Pacific region. Using Pb isotopes, this work traces the new dominant sources of emissions, which I expect to be coal combustion, trash incineration, and manufacturing.

805. The Effects of Timber Harvesting on Small Mammal Abundance, Tick Burden, and Foraging Behavior with Implications for Tick Densities

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Stephanie Hurd

Faculty Mentor: Allie Gardner

Abstract: Forest management occurs across spatial scales (e.g., property, landscape) to meet varied stakeholder objectives. This range of management affects wildlife habitat differently and has the potential to interrupt stages in the lifecycle of disease vectors, like ticks. The blacklegged tick, Ixodes scapularis, vectors Lyme disease, the most common tick-borne disease in the United States that threatens public health. Maine is among the states with the highest incidences of Lyme disease. Lyme disease transmission is heavily influenced by tick densities, which may depend on the abundance of wildlife hosts parasitized by I. scapularis. Forest management alters host habitat, yet little research has determined the effects of common, property scale practices like timber harvesting on these host populations. This project investigates the impact of timber harvesting on small mammal behavior and population sizes and its implications for tick-host encounter frequencies. Using a combination of techniques (i.e., live trapping, track plates, and foraging trays), this study assessed small mammal foraging and population sizes in forest stands with varied structural attributes. Results show the number of trees per acre positively correlates to small mammal population size, negatively correlates to the average larval tick burden on each individual, and has no effect on foraging behavior. Previous work showed higher I. scapularis densities in these forest stands with increased trees per acre and small mammal populations, indicating that host population size may be driving tick densities. These results suggest a biotic mechanism relating forest management practices to tick-borne pathogen transmission via host population size.

806. Effects of Lobster Shell Meal as a Soil Amendment on Verticillium Wilt and Potato Growth

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ross Sousa, Katherine Ashley

Faculty Mentor: Jianjun Hao

Abstract: The potato (Solanum tuberosum) is the most economically important crop in Maine, but has been challenged by many soilborne diseases such as potato early dying (Verticillium dahliae) as well as constrained by poor soil health. Compost and lobster shell meal (LSM) have been used to fertilize crops, and there is evidence that these soil amendments can promote beneficial microbial communities that may suppress pathogens. To explore the combined effect of LSM and compost as a disease suppressive tool, a greenhouse study was established, using potato 'Shepody' and treatments using various combinations of compost, LSM, and V. dahliae inoculum. Plants were evaluated for emergence, disease symptoms, height over time, and biomass after harvest. Initial results have shown there was little difference in plant emergence and plant height between treatments. However, compost with or without LSM was found to increase root biomass. LSM alone showed a decrease in the number of tubers, yet an increase in total tuber mass. Stem lesions caused by V. dahliae were larger on the compost treatments, while all treatments had similar disease ratings. However, further investigation will be required to determine if LSM is a useful tool in V. dahliae management.

807. Silvicultural Treatments Affect Adult Mosquito (Diptera: Culicidae) Abundance and Species Diversity in a Managed Forest

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Alyssa Marini

Faculty Mentor: Allison Gardner

Abstract: Mosquito-borne disease is a serious public health concern worldwide, and transmission may be facilitated by the creation of favorable habitat conditions by human activities. There are many important disease vector species inhabiting forested ecosystems, and timber harvesting treatments may play a role in altering the abundance of vector species. Silvicultural systems are defined as a plan that integrates specific harvesting, regeneration, and tending methods contributing to a healthy forest stand. Timber harvesting treatments can alter the diversity or abundance of adult mosquito species through a variety of mechanisms, such as heavily harvested stands may have fewer tree holes, providing habitat for developing larvae. The goal of this study was to analyze the response of adult mosquito abundance and diversity to different timber harvesting treatments. To test our hypotheses, mosquito surveillance was conducted from 6 June to 23 August 2022 in the DeMeritt University Forest in Old Town, Maine, across five different treatments: 1) hardwood stands with no recent harvest, and softwood stands with 2) no recent harvest, 3) overstory removal, 4) thinning, and 5) shelterwood establishment cuts. Light traps and infusion baited gravid traps were deployed to collect a diversity of adult mosquitoes in 13 forest stands. We collected a total of 4,843 mosquitoes with three dominant taxa that were Ochlerotatus japonicus (6.48%), an invasive mosquito, Anopheles puntipennis (6.48%), a vector species for West Nile virus, and Coquillettidia perturbans (67.33%), a vector species for both WNV and Eastern Equine Encephalitis. The no recent harvest in the hardwood stands treatment had a higher mosquito abundance compared to the other treatments, while the softwood thinning treatment had the lowest number of mosquitoes. Overall, the results suggest that the risk of arboviruses transmitted by vector species may be inhibited by forest management practices because of reduced Oc. japonicus, An.punctipennis and Cq. perturbans abundance.

808. Upgrading Regular Wood-fiber Insulation Panels to Structural Wall Sheathing Enabled by Cellulose Nanofibrils

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Rakibul Hossain

Faculty Mentor: Mehdi Tajvidi

Abstract: This study developed a low-density wood fiber insulation panel (WIP) with 100% petrochemical-free, bio-based adhesives with sufficient mechanical strength to be used for regular and structural wall sheathing applications. This study used cellulose nanofibrils (CNFs) and lignin-containing CNFs (LCNFs) as binders with mechanical pulp fibers. All panels had excellent thermal insulation properties, and the thermal resistivity values increased with the decrease in density. The mechanical properties of the WIPs increased with the increase in binder content, and panels made with 5 and 7.5% CNFs met the required mechanical and thermal properties to be used for regular and structural wall sheathing applications, respectively. Panels were made using hybridized binders (CNFs-LCNFs) at 5 and 7.5% binder content using different LCNF additions to CNFs. The mechanical and thermal properties of the panels decreased with the increase of LCNF addition but panels made with 20% substitution of CNFs by LCNF had no statistically significant differences in mechanical properties to those made with neat CNFs as the binder. The water resistance and thickness swelling properties of the panels were significantly improved by the addition of 2% wax with 1% alum. Larger panels (30 cm by 30 cm) were made in a pilot-scale trial with 5 and 7.5% CNF as binders with 0 and 2% wax using a large sheet former. The mechanical, physical, and thermal properties of the large panels made with 5 and 7.5% CNF as a binder (with 2% wax) met the required properties for regular and structural wall sheathing applications respectively. Large panels were made using 1 and 2% CNFs and varying starch content. Panels with 1% CNFs and 6% starch met the requirements for regular wall sheathing, and those made with 2% CNFs and 7.5% starch met the requirements for structural wall sheathing applications. Overall, the results confirm the potential of CNFs and LCNFs to be used as 100% bio-based adhesives to produce eco-friendly WIPs with excellent thermo-mechanical properties to be used for regular and structural wall sheathing applications.

809. Hygrothermal Simulation of a Wood-fiber Insulated Panel (WIP) Wall Assembly in Selected Climate Zones

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Liam O'Brien, Jacob Snow, Benjamin Herzog, Stephen Shaler

Faculty Mentor: Ling Li

Abstract: Decarbonization of current and future building stock is widely viewed as a major step on the pathway to achieving climate mitigation targets. Environmentally sustainable wood-based building materials can be utilized to increase energy efficiencies (heating/cooling) of existing buildings and new construction. The solution we propose herein are Wood-fiber Insulated Panels (WIPs), consisting of a wood fiber insulation (WFI) core adhesively bonded to engineered wood composite faces. WFI has shown great potential to be a cost-neutral, drop-in replacement for fossil-based insulation with several additional attributes, such as: vapor openness, excellent sound attenuation, and low embodied carbon. Domestic manufacturing of WFI by TimberHP (Madison, ME), North America's first WFI manufacturer, will begin production in 2023, thereby increasing the availability and affordability of these potential core materials domestically. The hygroscopic nature of WFI allows for seasonal moisture migration through the wall assembly, preventing water accumulation inside the envelope.

The objective of this research was to analyze the hygrothermal performance of an example WIP wall assembly, comprised of cross laminated timber (CLT), wood fiber insulation (WFI), wood structural panels (WSP), and a weather resistant barrier, using WUFI Pro software to assist in refining the WIP wall design(s). Simulations were performed in selected climate zones (cold/very cold, mixed/hot humid, marine) to predict the moisture conditions inside the wall envelope over time (5-year simulation). The results regarding the moisture content, temperature (T), and relative humidity (RH) distributions and mold growth risk indexes were analyzed and will be reported at the symposium. The analysis provides an understanding of how the envelope responds to interior and exterior climactic conditions and can be used to identify moisture related performance issues such as mold and fungal attack. Future work is to include field testing for verification of the WIP assembly design(s).

810. Developing an Enhanced Forest Inventory in Maine Using Airborne Laser Scanning: The Role of Calibration Plot Design and Data Quality

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Stephanie Willsey, David Sandilands, Aaron Weiskittel, Ian Prior

Faculty Mentor: Daniel Hayes

Abstract: Accurate and reliable inventories of forest resources are critical in developing and carrying out strategies for sustainable management. Where high data quality is coupled with effective calibration, remote sensing has emerged as an essential tool for measuring and monitoring forest resources. In this proposed study, we will investigate a range of forest inventory designs to determine the best ground-based calibration plot specifications for developing enhanced forest inventories (EFIs) based on airborne laser scanning (ALS) data. While development involving ALS-derived EFIs has been advanced in some parts of the world, research is required to determine "best practices" in applying these approaches to the mixed-species, structurally complex, and intensively managed forests of Maine. To do this, we will test the effects of varying calibration plot type and design on EFI model performance as applied to several areas of interest across the state. We will evaluate the different forest inventory designs based on both quantitative model performance as well as implementation efficiency to establish the optimal calibration plot design for ALS in our study areas. Once the best forest inventory calibration plot design is identified and validated, it can be applied to estimate a suite of forest inventory attributes (e.g., tree count, hardwood/softwood composition, basal area, and volume) that are required across numerous research and operations applications. We expect the optimal calibration plot design to vary spatially because Maine has several different forest ecotypes with a range of disturbance histories.

811. Did Ice Age Snowlines Lower by the Same Amount Globally? Tropical Glaciers Say Yes!

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Emilie Casey, Meredith Kelly

Faculty Mentor: Alice Doughty

Abstract: Glacier size mainly depends on temperature, precipitation, and topography, affecting where the ice starts to freeze or melt (called the freezing line). By determining the elevation of this freezing line during the Last Glacial Maximum (LGM, ~20,000 years ago), we can see how tropical glaciers responded to climate change and better predict how they will respond in the future. Finding the conditions that created these glaciers in the past helps understand the variability in the upper atmosphere climate. In this study, we focused on glacier model output of reconstructed LGM glaciers in the Rwenzori Mountains, Uganda (0.4°N 29.9°E). We created code in MATLAB to extract freezing line elevations based on model temperature input, with factors including elevation, lapse rate, modern temperature and its change since LGM. Then, we compared the determined freezing line to those in the mid-latitudes in order to have a better understanding of the global pattern of cooling during the LGM. The change in the freezing line between modern and LGM appears to be similar across the tropics and mid-latitudes. These results support a theory in current research; it will support paleoclimate scientists in understanding the cause of ice ages and better predict future glacier behavior.

812. Synthesis of Novel Fluorescent Probe for Biomass Degradation

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mary Milligan

Faculty Mentor: Matthew Brichacek

Abstract: Glycans make up cell walls that allow for defense, energy metabolism, and signaling. Within the classes of glycans is xylan, which is a major component of plant biomass and secondary cell walls. The prevalence of glycans in almost all plants makes them a great source for studies in the field of renewable energy. The inability to degrade the bonds present in xylan is the major impediment to utilizing xylan as a biofuel. Using a new assay, we propose to degrade xylan molecules, through bioprospecting, utilizing the novel reagent, 4-methylumbelliferone iodonium triflate (4-MU). The chemical synthesis of the 4-MU probe commenced from xylose. Direct arylation of xylose was unsuccessful due to the poor solubility of the sugar in toluene. The use of a tetra-substituted sugar molecule was succesful though. Subsequently, copper-catalyzed arylation of a silylated xylose derivative was pursued. Analysis of the reactions was done by Thin-Layer Chromatography, Flash Column Chromatography, and Nuclear Magnetic Resonance. Future studies will utilize these 4-MU-xylose molecules to identify enzymes capable of breaking down xylan.

813. Capturing Englacial Deformation with Autonomous Phase Sensitive Radar (ApRES) on Lemon Creek Glacier and Begguya (Mt. Hunter) Plateau, Alaska.

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Emma Erwin, Ingalise Kindstedt

Faculty Mentor: Seth Campbell

Abstract: The Autonomous Phase Sensitive Radar (ApRES) uses a frequency modulated continuous wavelength to detect englacial stratigraphy with millimeter precision. By repeating measurements over an interval of time, vertical deformation of englacial layers is captured. Here, we present findings from deploying the ApRES on two different glaciers in Alaska: Lemon Creek glacier (Juneau Icefield) and the Begguya summit plateau (Denali National Park). Deployment of the ApRES at these two study sites confirms the efficacy of the instrument in both temperate (Juneau) and high alpine (Denali) environments. On the Juneau Icefield, measurements were collected over a 24-hour period at a single location, followed by a series of sensitivity tests. On the Begguya plateau, 22 point measurements were collected at 50 m spacing along the cross-sections of an approximately 600 square meter grid. These measurements were repeated after 14 days to evaluate change in depth of englacial features. The same suite of sensitivity tests was conducted on the Begguya plateau to compare with those collected on the Juneau Icefield. At both locations, 10 MHz ground penetrating radar (GPR) transects were collected to compare bed depth measurements and englacial stratigraphy between the two instruments and to assess the impact of basal topography on the relative coherence of the reflected ApRES signals. Radar data is processed with ImpDAR and shows stronger coherence between repeat measurements on Begguya compared to Lemon Creek. Data from both sites reveal strong reflectors consistent with basal topography imaged with GPR.

814. Preliminary Investigation of Trends Associated with Environmental Media and Chain Length of Per- and Polyfluoroalkyl Substances (PFAS) in Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Alex Scearce, Jonathan Malacarne

Faculty Mentor: Rachel Schattman, Jonathan Malacarne

Abstract: Per- and polyfluoroalkyl substances (PFAS) are widespread anthropogenic contaminants first introduced to the environment in the 1940s. PFAS have infiltrated the food system due to the spreading of PFAS-contaminated biosolids on agricultural lands as a fertilizer alternative. Variation in biosolid sources and application have led to a range of concentrations of PFAS in Maine farmland soil and groundwater, causing detriment to farmers, public health, and the economy. Long-chain PFAS are on the forefront of concern and have been the first form of PFAS to undergo regulation. However, recent research provides reason to consider high concentrations of novel short-chain PFAS just as harmful to human and environmental health as long-chain. The concern around short chain is due to the high concentrations at which they are found and their molecular composition, which behaves similarly to long chain PFAS. Through this research I show that: 1) Groundwater sampling is more common than soil sampling, 2) Long chain PFAS are found in higher concentrations across Maine in both groundwater and soil, and 3) Higher concentrations of PFAS are a result of the interaction of media and chain length, with highest concentrations being long chain PFAS in groundwater. This preliminary analysis will be useful to inform future research conducted by our research group to target PFAS with phytomanagement techniques and to inform policy on decision-making surrounding PFAS testing.

815. Food Insecurity and Food Allergies

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Kjersti Conway

Faculty Mentor: Kelsi Hobbs

Abstract: Food security continues to be an issue for low- to moderate-income families in the United States (US). Data from the 2021 Current Population Survey Food Security Supplement shows that 32.1 percent of households living below the poverty line experience food insecurity. The prevalence of food insecurity across the US differs due to demographics, economics, and state-level policies. However, there may be other reasons why some families are more likely to experience food insecurity than others. Given that food insecurity continues to be an issue for many US families, it is important to understand what may lead to or exacerbate food insecurity. This paper studies the relationship between food allergies and food insecurity. Using individual- and household-level data from the National Household Food Acquisition and Purchase Survey (FoodAPS), we estimate the relationship between food allergies and food insecurity with Ordinary Least Squares (OLS).

816. Ice Age Glaciers of Tropical New Guinea

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kaidar Donenbayev, Meredith Kelly

Faculty Mentor: Alice Doughty

Abstract: Glaciers transform the terrain around them, and when they shrink or disappear, they leave behind markers of their past extents in the form of deposits called moraines. Using a MATLAB glacier modeling program, elevation data, climate data, and a specific amount of cooling, we modeled past glaciers in Mount Giluwe in Papua New Guinea (6°N, 143.9°E) at ~20,000 years ago (last Ice Age). This project helps us to have a better understanding of how glaciers looked in the past and how they changed over time and to predict how glaciers react to different conditions such as temperature, precipitation, etc. For this project, we gathered climate information from different publications and marked moraines in ArcGIS from satellite imagery. We tested a range of past climate possibilities, which resulted in the model glacier matching the moraines. From the model results we estimated past snowline elevation and the extent of the glaciers on Mount Giluwe. These results complement the lack of data in the field of tropical glaciers and help us understand tropical climate change.

817. Lactation Support on Low-Income Women Exclusively Breastfeeding

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kayla Lorenc, Ashley Holmes, Camryn Brown, Morgan Ireland, Ada Hepler

Faculty Mentor: Valerie Herbert

Abstract: Low-socioeconomic-status new mothers who wish to exclusively breastfeed, face significant challenges associated with available resources, finances, and maternal leave. To address this issue, the authors explored the following evidence-based PICOT question: among low-socioeconomic-status new mothers that breastfeed, does access to lactation supports in the workplace, compared to no or limited access, affect their ability to exclusively breastfeed for the baby's first six months? This project conducted a search of the literature in CINAHL and PubMed databases using the terms breastfeeding, low-socioeconomic-status, and workplace lactational support. Inclusion criteria included peer-reviewed articles published between 2017 to present, containing keywords/phrases used in the search. Articles that did not discuss lactation support for low-socioeconomic-status breastfeeding women were excluded. Longer maternity leave is associated with increased breastfeeding duration. The literature highlights for working new mothers, lactation support in the workplace includes breastfeeding breaks, flexible work arrangements, private spaces, and facilities for expressing breast milk (Dinour & Szaro, 2017). For women of low-socioeconomic status an extended maternity leave may not be feasible, presenting women with challenges to exclusively breastfeed for the first six months. Additionally, research indicates that for women returning to work, workplace lactational supports are needed to improve the duration of exclusive breastfeeding. Low-income mothers are significantly less likely to have access to extended maternity leave, and lack necessary accommodations within the workplace, including break time and/or a private space to express breast milk. When workplace lactation is supported there is a positive influence on exclusive breastfeeding for 6 months.

818. Citizen Perceptions of the Sustainability of Marine Aquaculture

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Bruce Wyatt

Faculty Mentor: Caroline Noblet

Abstract: As the world confronts the need for sustainable food systems, marine aquaculture serves as a key opportunity to produce safe, sustainable seafood. However, marine aquaculture still faces social resistance to its adoption with environmental and economic concerns leading to citizen and consumer hesitations regarding the industry and its products. In this study, we explore factors that lead to a citizen holding primarily positive or negative views of marine aquaculture with a focus on whether these views are driven by environmental or economic perceptions. Using a survey of Maine coastal residents (n=295), we find that subjects whose use of the Maine coast has been positively impacted by marine aquaculture were more likely to view marine aquaculture as positive, less likely to have concerns over the implementation of marine aquaculture farms, and more likely to view mariculture as both environmentally and economically positive. Additionally, subjects who were unemployed and experiencing financial hardship were more likely to view marine aquaculture as having negative economic impacts along with other associated negative impacts on communities. Finally, we find that subjects who think they need to know more about marine aquaculture and have high financial hardship are less likely to view mariculture as economically positive. In contrast participants who thought they needed to know more about marine aquaculture and have low financial hardship were more likely to view the industry as economically positive. Understanding public perception of marine aquaculture ensures that coastal managers can make decisions that are consistent with preferred uses of Maine's coastline.

819. Observations on the Effect of Commercial Harvesting of Alitta virens as a Keynote Species

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Taylor King

Faculty Mentor: Brian Beal

Abstract: Alitta virens is essential as a keystone species in their ability to control populations of Corophium volutator, and prevent them from outcompeting other essential infaunal species in the local soft-bottom communities of Downeast Maine. The effect of commercial harvesting on this keystone species could have a negative impact on the structure of these soft-bottom communities through the removal of A. virens. Samples were collected from Larrabee Cove and Sanborn Cove across three tidal heights, and the average abundance of C. volutator, the average abundance and size of A. virens, the average species diversity, and the average depth to the hardpan layer were measured and tested. Unforeseen and uncontrolled artifacts had a significant impact on the data and should be viewed with caution, but this does open up the possibility of similar future studies being done with these artifacts being controlled for.

820. Enhancement of CNF Barrier Properties by Nanofibril Alignment

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Nabanita Das, Islam Hafez, Douglas Bousfield

Faculty Mentor: Mehdi Tajvidi

Abstract: Cellulose nanofibrils (CNFs) are one of the most viable alternatives in the quest to replace petroleum-based plastic packaging to protect the environment from hazardous plastic pollution. At low relative humidity, cellulose nanofibrils offer better oxygen barrier properties than many conventional plastics. Their orientation can enhance the mechanical strength and oxygen and water vapor barrier qualities of cellulose nanofibrils. However, there needs to be more information available about how CNFs can be aligned in the film to impart enhanced gas barrier properties. In this regard, we will use two different fabrication techniques (casting and dynamic sheet forming) and attempt to orient the CNF particles in the films to improve their barrier properties. We anticipate that the dynamic sheet-forming approach will lead to better film alignment. Based on the birefringence orientation index (BOI) values derived from trial data, the films are oriented in the direction of rotation, and it can be predicted that when BOI increases, mechanical strength and barrier characteristics will also increase. Additionally, we will also develop multilayer, oriented cellulose nanofibril films. Compared to single-layer CNF films, multilayer films should exhibit significantly better barrier properties. To create a safe and plastic pollution-free future, our initiative will help develop sustainable, environmentally friendly, and renewable packaging materials.

821. Firn and Snow Properties on the Kahiltna Glacier, Denali National Park, Alaska

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Scott Braddock

Faculty Mentor: Seth Campbell

Abstract: Presently, a majority of sea level rise is attributed to ice loss from mountain glaciers. However, there remains uncertainty in how much and how fast glaciers and ice sheets will continue to retreat in the coming centuries and contribute to ocean volume changes. Here, we address one source of uncertainty in glacier mass-balance measurements attributed to the ability of firn (a sub-surface layer in the transition of snow to ice) to retain melt water that ultimately is stored within the glacier and not routed immediately to the ocean. We ski-tow collected a 13.4 km 400 MHz ground-penetrating radar profile between 3400 m and 2000 m above sea level (asl) on the Kahiltna Glacier, Denali National Park, Alaska in June, 2022 to quantify thickness and structure across this large elevation range. Results show stratigraphy down to 50 m at elevations between 3400 and 2800 m asl. Around 2300 m asl, our data no longer displays stratigraphy and this is likely due to water content in the snowpack and thin firn which exists at lower elevations of Kahiltna Glacier. Our next step is to quantify temporal changes in firn thickness and its associated capacity for water storage. To account for temporal changes in the snow and firn packs, we are in the process of comparing the 2022 dataset with GPR data collected along the same route in 2010.

822. Establishing Long Term Monitoring of Atlantic Bluefin Tuna (Thunnus thynnus) Foraging Ecology in the Gulf of Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Blaise Jenner

Faculty Mentor: Walter Golet

Abstract: Atlantic bluefin tuna (Thunnus thynnus; ABT) in the Gulf of Maine (GOM) have a diverse diet with lipid rich clupeid species being the most important dietary item for this species over the past several decades. In recent years, dominant prey items such as Atlantic herring (Clupea harengus) no longer represent the most abundant prey species, and the prevalence of Atlantic herring have been replaced with species like short fin squid (Illex illecebrosus), silver hake (Merluccius bilinearis) and Atlantic menhaden (Brevoorita tyrannus).
Recent studies (Nadeau, 2021) have documented this change in the primary prey species for ABT, however, it’s very important to determine if these changes represent a fundamental shift in the composition of available prey resources and what if any impact this may have on the temporal and spatial distribution of ABT in the GOM. To determine if this shift in diet is representative of a long-term trend or a short-term change in foraging ecology of ABT, a new long-term partnership between the Maine Department of Marine Resources and the Pelagic Fisheries Lab at the University of Maine has been initiated.
To evaluate the foraging ecology of ABT, stomach content analysis (SCA) of commercial sized (>185cm CFL) ABT will be performed annually, in addition stable isotope analysis (SIA) of liver tissue will be performed as a longer-term tracer of dietary preferences. Capture induced regurgitation, rapid digestion rates, and a limited temporal scale, can lead to biased results from SCA, making SIA a valuable and complimentary method for determining foraging ecology. As fisheries managers move toward more holistic approaches of management, having accurate and up to date foraging ecology data on ABT will not only benefit the management of ABT but also of the forage species it depends on.

823. Stratigraphic Architecture of Pozuelo Mounds as by Electromagnetic Resistivity Surveys

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Caeli Connolly

Faculty Mentor: Daniel Sandweiss

Abstract: This study is a geoarchaeological analysis using electromagnetic resistivity (ERT) surveys of Pozuelo Culture (Formative Period, ca. 3000 BP) mounds (B and D) at Pozuelo in the Chincha Valley of coastal, southern Peru. Layers identified in the subsurface will be used to determine if there is a regional continuity between the different mounds. This effort is part of a larger investigation examining the paleoenvironmental setting of the site, and its influence on site location and use. In June, our research team spent 10 days in the field collecting ERT data at two of the four Pozuelo mounds and conducting stratigraphic analysis at an open excavation, unit 31, at Mound D. For this study, ERT lines were located over Mounds B and D and the surrounding, low lying fields. The data were collected using an ABEM Terrameter LS2 with an 81 pin set up. The pins were spaced 0.5 to 5m apart, depending on depth penetration and resolution desired. The ERT data will be topographically corrected and ground-truthed using existing stratigraphic information from archaeological unit 31, located on Mound D. This thesis looks to relate the ERT subsurface structures between Mound B and D together and connect the ERT structures to the stratigraphic layers observed in unit 31. Preliminary data analysis suggests there is a strong connection between the structures observed in Mound D and the stratigraphic layers in unit 31, and a mound-within-mound structure in Mound B.

824. Multispectral Analysis of a *Sphagnum* Moss-Dominant Peatland to Monitor Hydrologic Conditions

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Victoria Niedzinski, Benjamin Poulter

Faculty Mentor: Andrew Reeve

Abstract: Peatlands are complex systems with significant controls on global carbon cycling as both carbon sinks and methane emitters. Globally, peatlands cover <3% of all land surfaces but contain one-third to one-half of all global soil carbon. Changes in land use and climate are often associated with changes in the water table position of peatlands, which directly impact carbon sequestration, methane emissions, and vegetation productivity. Hydrologic processes have a significant influence on overall nutrient cycling throughout the peat basin and dictate the productivity of methane-producing microbes and anaerobic decomposition. Generally, a lower water table is linked with decreased levels of carbon sequestration and methane emissions as well as decreased vegetative productivity, particularly in *Sphagnum* moss. However, monitoring water table changes in peatland complexes over time is very field-intensive and often not feasible in more remote areas. Recent laboratory experiments found that during periods of water stress (i.e., lower water table) the spectral reflectance of *Sphagnum* moss increases in the visible, NIR, and SWIR wavelengths. This project expands on these results by using reflectance values obtained from satellite multispectral images of a *Sphagnum* moss-dominant peatland (Caribou Bog, Bangor, ME) over a year and correlates them to past field measurements and an ongoing groundwater modeling project for the same area. This correlation provides a low-cost method to remotely assess the hydrologic conditions of peatlands in hard-to-reach areas and can be further utilized as a proxy to estimate carbon cycling and methane emissions.

825. Educating the Future about Maine Outdoor Recreation

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Joseph LaFlamme

Faculty Mentor: Jessica Leahy

Abstract: The purpose of my project was to provide an educational experience for interested youth at a local high school. Through my years at the University of Maine I have gained a deeper knowledge and love for the many aspects of outdoor recreation. Key events throughout the history of our country and state were made possible by a few individuals that followed their passion for the outdoors in order to provide recreation opportunities to be protected into the future. I hope to ignite a similar passion in these students in order to set them down a path to further advance this misission. Through my seminar I hope I was able to pass knowledge of recreation opportunities along with environmental protection practices in order to preserve our recreation areas and the ecosystems within. I worked to reach this outcome through the use of interactive activities, an engaging slide show presentation, and a guest speaker from the department of Inland Fisheries and Wildlife. The many interactive activities with industry professionals throughout my years of schooling has given me an appreciation for the use of a knowledgeable outside party inorder to engage and inform an audience. Together we were able to excite part of the upcoming generation to be engaged in a career and lifestyle that is oriented around the protection and use of our natural spaces. Students were able to see opportunities for growth within the industry and were informed about steps throughout the University of Maine and other outside experiences that could lead them to a related career.

826. Relationship Between *Asterias rubens* Size and Prey Size Preference on the Blue Mussel *Mytilus edulis*

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Evan Busch, Taylor King, Jamie Merriam

Faculty Mentor: Brian Beal

Abstract: *Mytilus edulis* is an important species for its commercial value and as a bioengineer in the intertidal shores of the Maine coast. *Asterias rubens* is a predatory benthic marine echinoderm that occupies the same habitat and preys upon *M. edulis*, potentially affecting species diversity and aquacultural production. Under optimal foraging theory, predators such as *A. rubens* should target the largest available prey item available to them in order to maximize energy efficiency. Constraints such as risk of damage to the stomach caused by sudden shell valve closure would negate the energy efficiency of targeting the largest available prey. Therefore, *A. rubens* individuals may not follow the optimal foraging theory and instead target smaller prey items to avoid potential harm to feeding appendages and structures. The size of *A. rubens* prey preference could change over time as the individual becomes larger and stronger, allowing it to potentially target larger prey items. Using replicated regression analysis, we determined that there was a size refuge for *M. edulis* based on the maximum prey size that a given *A. rubens* individual can consume, but not from *M. edulis* individuals being too small. In this population, *A. rubens* did not follow the optimal foraging theory, and instead fed on the smallest and middle mussel size class more than the large size class. Moving forward, more continuous survival data, longer trial durations, and careful maintenance of *A. rubens* individuals within the same experimental unit can help control for experimental artifacts and determine more accurate relationship data.

827. Building Ski Trails for the University Forest

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Thomas Angelo, Drake McAfee

Faculty Mentor: Jessica Leahy

Abstract: Our Capstone project goal was to create new cross-country ski opportunities in the University Forest. It consists of three sections of trail, two which already exist. One trail is ~1.5 miles long, and we are building that one from scratch. The two other trails, both shorter than a mile, are widened for trail-grooming. We scouted the trails out first, mapping them onto Avenza maps with lots of photo documentation. The next step is flagging them out so that no electronics are necessary to walk the walk. We will talk about the mapping process as well, yet to be accomplished. We will talk the trailwork process as well, including estimating the man hours and costs necessary to do the work, and planning the work itself. This will consist of our own efforts as well as a class workday (or two?) We'll see how many man hours we need. We will include aspects of trail management and recreation opportunities posed to the surrounding area as well to cater more to the tourism part of PRT. We will go into depth on the new opportunities and the downfalls that it may bring, as nearby parking area is boggy and small. Our poster describes wildlife management as well, including how our trail will impact their habitat and numbers. If we look at how the number of people that come the new ski trail, there might be in an increase in the number of people that litter, thus more animals might be attracted to the area. We can touch on the long-term usage regarding erosion, and year-round usage.

828. Halsey Outdoor Classroom Improvement Project

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Dominic Mezzadri

Faculty Mentor: Jessica Leahy

Abstract: This poster will describe my Parks, Recreation, and Tourism capstone project, in which I decided to improve the Halsey Outdoor Classroom, located in Orono next to the University of Maine. It is owned and maintained by the Orono Land Trust under a conservation easement. Discussions were with the Orono Land Trust, and project ideas were tossed around about what would serve the property best, since it wasn't used as a classroom as often. The best course of action was determined to be cleaning up/widening the trails, as well as adding an interpretive element to the site featuring the history of the land and its management. The two components of this project were a trail clean-up day and designing interpretive signage for a small trail. A clean-up day was organized with the University of Maine Woodsmen Team, which I am a part of, due to their experience with hand tools, cutting trees, etc. The clean-up was a few hours long. In terms of tasks accomplished, debris such as fallen trees were removed from the trails, and the trails were opened up and widened. The interpretive signage is primarily focused on the history of the property. General principles of proper interpretive sign design were used in the process and the information was primarily sourced from old documents and photographs collected from long-time land trust members. Information on the site vegetation was sourced from forest vegetation and biology textbooks. Signage was printed out and put into existing holders, then placed along the loop trail at the site. In conclusion, the project allowed me to utilize important skills in the field of Parks and Recreation such as volunteer coordination, interpretive sign design, and trail clean up.

829. Piney Knoll Conservation Area

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Stuart Salom, Matt Dymowski, Caleb Heuss

Faculty Mentor: Jessica Leahy

Abstract: For our capstone project, we chose to help the Orono Land Trust replace a bridge at one of their properties, Piney Knoll. This project is important because the old bridge had deteriorated over time to the point where it may pose a risk to people who use the trail for recreation, for example bikers. Bikers have continuously gotten their tires caught in between the two boards that made up the bridge, creating great risk to people utilizing this trail. It is also very important to keep a bridge there for bikers as there is a flooding problem. This can pose a risk to the environment if it wasn't there due to the amount of use used on that trail. Without the bridge it would cause deep depressions after flooding which will ruin the trail and could pose risk to agriculture nearby. Jennifer Dann, the Steward of Piney Knoll Conservation Area introduced us to this project and stressed the importance of this work as it was a priority for the land trust. We devised a new plan with new materials and a new build design that would produce an improved bridge that would be long-lasting, safe for bikers and hikers, and could be easily maintained. The materials we used were provided by the Orono Land Trust. In the design stage of the project, we met with different experts to help decide how to best build the bridge. When assembling and installing the bridge, we utilized tools supplied by the Orono land trust such as a tractor which was imperative to the project being built efficiently. We were also fortunate to enlist the help of volunteers. In conclusion, we were able to remove a bridge that wasn't up to the standards of Orono Land Trust and install a new bridge with a new design that should last longer than the previous design.

830. Technical Trail Description Signs for Increased Accessibility at Coastal Mountains Land Trust's Round the Mountain Trail in Camden, Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ryan Nascimento

Faculty Mentor: Jessica Leahy

Abstract: This project focuses on increasing accessibility using the Americans with Disability Act (ADA) and Architectural Barriers Act's (ABA) 2004 guidelines for trails to the Round the Mountain Trail (RTM) of Ragged Mountain Preserve in Camden, Maine. The preserve is protected and maintained by Coastal Mountains Land Trust (CMLT), a local conservation non-profit organization and community partner for this project. The process began with a trial project during the summer of 2022 on the Beech Hill Preserve in Rockport, Maine, another preserve under easement by CMLT. Reflections were made on the trial project and grant money awarded to CMLT for accessibility projects was used to purchase an electronic level, a hypsometer, and pin flags. The measuring process of the RTM occurred during the fall of 2022 which consisted of measuring trail length, elevation gain, elevation loss, average and maximum grade, average and maximum cross slope (out slope), average and minimum tread width, and typical and irregular surface types or features. The next step was working with CMLT staff and board to receive feedback on the signage design from the trial project and improve the signage to meet recommendations. The next step was to send the signs for printing using grant money obtained by CMLT. The signs will be implemented in late spring/early summer of 2023 once the ground has thawed. A CMLT learning session will be held during their April board meeting to conclude the project.

831. Surry Forest Signage

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Aja Quintal

Faculty Mentor: Jessica Leahy

Abstract: The purpose for this project is to assist Blue Hill Heritage Trust (BHHT) with creating signage for a local trail that is the site of active forest restoration and native plant restoration. Aja has worked with two Wabanaki members to include indigenous knowledge about native plants, plants that are beneficial to pollinators, and how climate change has created an opportunity to reintroduce extirpated species that were native to the area at one time and were important mast species. The goals for this project is to create 2 signs for Surry Forest showcasing these planting efforts as well as amplifying indigenous voices and knowledge. These signs are meant to be accessible to folks of all different knowledge levels due to the proximity of the trail to local schools and the accessibility of the trail itself. The outcome of this project which will be shown on the poster will be 2 signs that are showcasing key species that are valuable to the landscape, indigenous people, native flora and fauna, and for knowledge about the area.

832. Instruction of Outdoor Adventure Activities with Telstar Freshman Academy

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ryan Walsh, John Probert

Faculty Mentor: Jessica Leahy

Abstract: In Bethel, Maine, Telstar Freshman Academy provides students from Telstar Middle School with experiential, outdoor and traditional education practices. Over the course of the academic school year, 9th grade high school students are bussed to Bryant Pond 4H Camp. Here they participate in outdoor activities alongside their core school curriculum. For our senior capstone project, we engaged with TFA to enhance their climbing unit. We developed a five-day multifaceted climbing program. Each day there were three sessions with ~15 students rotating every hour. The lessons were designed using knowledge from our parks, recreation & tourism and outdoor leadership courses to support TFA's mission while providing students with technical rock climbing skills. We also designed the program to encourage teamwork and thoughtful reflection. Our goal was for TFA youth to develop critical interpersonal skills that extend beyond the classroom.

833. Correlation between Bioluminescence and Pigments Absorption in the Equatorial Pacific Ocean

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Noah Bourassa, Guillaume Bourdin

Faculty Mentor: Emmanuel Boss

Abstract: Understanding the ecology of organisms associated with bioluminescence is of interest to a wide variety of people especially the Navy since mechanically stimulated bioluminescence can reveal submerged divers or submarines. Here we investigate potential correlation between bioluminescence and pigments absorption in the Equatorial Pacific Ocean. Bioluminescence data was collected using an Underwater Bioluminescence Assessment Tool (UBAT, SeaBird Sci.) on the research vessel Tara along with inherent optical properties of the surface ocean. The UBAT measures mechanically stimulated bioluminescence potential by stirring up an inflow of sea water with an impeller within a detection chamber that detects emitted light. Spatial distribution of the data revealed that bioluminescence was most prominent at sites along the Eastern coast of Australia, the coast of California, and along the coast of the Pacific Northwest of the United States.

Bioluminescence was positively correlated with the total chlorophyll a concentration, dissolved organic matter fluorescence, two types of chlorophyll pigments (chlorophyll c and chlorophyll b), and photosynthetic carotenoids. All the positively correlated pigments are common to dinoflagellates, which are known to include bioluminescent organisms. These validate the use of the UBAT to detect the presence of bioluminescent organisms.

834. Investigation of Ancient Basal Ice from Begguya (Mt. Hunter)

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Madeline Gavin, Carina Keirstead, Shannon Thompson, Hanna Brooks

Faculty Mentor: Dominic Winski

Abstract: The two most abundant stable variants of oxygen isotopes are oxygen-16 (light) and oxygen-18 (heavy). The ratio between these isotopes changes with climate since it is influenced by evaporation and condensation. Water molecules with light oxygen evaporate more readily, while heavy isotopes condense more readily. Since most atmospheric water molecules condense before reaching cold glaciated regions, oxygen isotope ratios in ice core samples can be used as a thermometer. Here, less heavy oxygen in the frozen water means that temperatures were cooler. In this way, glaciers play an important role in giving scientists a glimpse into the past.

The ice taken from Begguya, Alaska is predicted to be from the Holocene (10,000 years old) although the true age remains unknown. In 2013, twin ice cores (DEN-13A and DEN-13B) were drilled to bedrock with a length of 210 m. Samples from ice in DEN-13A (tube 222-231) and DEN13-B (tube 220-236) are being analyzed using a Picarro L-2130-I Isotopic H2O Laser Ring Down Spectrometer to measure the isotopes by laser absorption spectrophotometry in the UMaine Climate Change Institute Stable Isotope Lab. Our goal is to assemble a record of past changes in water isotope ratios from Begguya that can be matched with known past variability from previously drilled ice cores in order to determine an age. Preliminary findings from DEN13-B point to the oldest ice being from the Younger Dryas period (~11,600 years old).

835. Assessing the Small Animal Veterinary Needs of Rural Maine and Implementing an Effective Management Plan

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Marielle Pelletier, Tegwin Taylor

Faculty Mentor: Sue Ishaq

Abstract: In Maine, the need for veterinarians is at an all-time high; the large animal (NIFA, 2022) and equine veterinary shortage (Parker, 2021) has been documented and there are mechanisms in place to help alleviate this shortage. In January 2022, LD 1885 (An Act To Increase Maine's Veterinary Workforce) was amended to propose the inclusion of critical and emergency veterinary service shortages (An Act To Increase Maine's Veterinary Workforce, 2022). Maine has methods to evaluate the shortage of large animal service, but the shortage of companion animal services is not fully described or represented. In order to evaluate Maine’s need for small animal services, a needs assessment was conducted. With implementation of the Pets For Life Community Outreach Toolkit (Humane Society of the U.S., 2021), gaps in Maine veterinary services will be identified. This information will help answer the question: How can the demand for companion animal veterinarians in underserved communities be meaningfully represented and how can those communities be managed appropriately? What incentives can we offer for veterinarians to encourage commitment to these areas? The long-term goal is to represent the veterinary shortage in a way that is coherent for non-veterinary professionals. With a better understanding and assessment of veterinary needs in the state, Maine policymakers will be targeted to help solve the issue and improve veterinary services in rural communities.

836. Inheritance and Fitness Costs of Insecticide Resistance in the Colorado Potato Beetle

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Donne Sinderson, Olivia Bishop, Jordan Hall, Everett Pietella

Faculty Mentor: Andrei Alyokhin

Abstract: Colorado potato beetle, Leptinotarsa decemlineata (Say), is one of the most important defoliating pests of potato, in big part because conventional control methods on commercial farms have led to resistance to numerous insecticides in most beetle populations. Understanding genetics of insecticide resistance is essential for developing scientifically sound integrated management plans that provide effective beetle control while preventing further insecticide failures due to resistance development. We searched a Web of Science database for original research publications on dominance and fitness costs of resistance and then narrowed down results by reading the retrieved articles and eliminating those not relevant to the topic. Subsequent meta-analysis of the obtained data revealed that insecticide resistance in the studied beetle populations was either recessive or incompletely dominant, with no dominant inheritance reported in any of the published studies. Fitness costs, including reduced reproductive output, lower life expectancy, and, to a smaller degree, prolonged time of development, were common. This has important implications for resistance management by supporting the use of a high dose/refuge approach.

837. Assessing Potato Haploid Induction From Diploid Solanum tuberosum Selections

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Noah Williams

Faculty Mentor: Ek Han Tan

Abstract: Potato (S. tuberosum) is a widely grown vegetable crop in Maine and in the world. Most potato varieties developed at the University of Maine and in the United States are tetraploids (4x). However, potato and its wild relatives exist in a range of ploidies. The overwhelming majority of commercial cultivars are tetraploid (4x) while many landraces and related tuber-bearing Solanum species are diploid (2x). As a highly heterozygous polyploid, inbreeding tetraploid potatoes is impractical. Challenges in inbred potato line development have prevented breeders from establishing an F1 hybrid breeding system for potatoes. In contrast to tetraploid potatoes, diploid potatoes that can be self fertilized may be used to create inbred lines. With additional ploidy manipulation, inbred development can be expedited. In this work, we will test potato haploid inducers (PL4 and IVP48) to create potato haploids by crossing selected diploid (2x) lines. If we are able to isolate monoploid (1x) lines, we will attempt chromosome doubling using colchicine treatments to generate a fully inbred diploid potato (2x) in one generation. Previous doubled monoploids have been developed with this method, but poor fertility and agronomic traits have hindered their utility in breeding programs. Developing doubled monoploids from improved diploid germplasm can produce more fertile, fully inbred lines to accelerate diploid F1 hybrid potato breeding.

838. Response of Photosynthesis to Light and Extreme Heat in Three New England Tree Species

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Bean Bein, Alexandra Barry

Faculty Mentor: Jay Wason

Abstract: Temperatures are projected to continue rising in the northeastern United States leading to an increased likelihood of extreme heat events. These heat events may reduce the physiology and growth of cold-adapted New England trees. To better predict how different light conditions and heat waves may impact forests in this region, we measured the physiological response of tree seedlings of red spruce (Picea rubens), paper birch (Betula papyrifera), and northern red oak (Quercus rubra) to changes in light levels and temperature. We generated leaf-level light and temperature response curves using a portable photosynthesis system (LI-6400XT) at different light intensities and temperatures. To determine how physiological responses affected growth, these readings were then compared to height and diameter growth of seedlings from ambient conditions or in passive warming chambers. It was found that the 2-week heat wave drove an increase in average daily maximum temperatures of 3.5℃. We also found that photosynthesis declined strongly with increasing temperatures for all species, particularly above 30℃. However, the relatively short duration of heat stress had little to no effect on height and diameter growth for all species within this first growing season. In contrast, the photosynthetic response to light explained much of the variation in growth between the three species. Collectively, these results suggest that although this relatively modest heat wave had only minor effects on growth, our physiological measurements support the notion that continued climate warming and more extreme heat waves may be a key driver of projected declines in boreal species.

839. Extraction and Characterization of Antifungal Compounds Produced by Lowbush Blueberry Plants in Response to Monilinia vaccinii-corymbosi Infection

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sophia Suriano

Faculty Mentor: Seanna Annis

Abstract: Maine's wild blueberry population is a vital economic and ecological resource for growers, consumers, and researchers alike. Fungal diseases like Monilinia vaccinii-corymbosi (MVC) reduce the yield of berries on an infected plant by killing plant tissues and infecting fruit. Understanding what blueberry plants use to defend themselves against fungal pathogens can give a greater insight into increasing plant immunity as a whole. This project aims to better understand the wild blueberry antifungal defense response. I will extract bioactive solutions from the healthy leaves of low severity and high severity disease-affected plants and separate the molecules with thin layer chromatography (TLC). Aspergillus sp. will act as a fungal model. Spores will be mixed into an agarose medium and applied to the TLC plates using a spray apparatus. The solutions displaying antifungal activity will inhibit the growth of the fungus, leaving uncolonized patches on the plate. The areas with inhibition will be isolated and chemically characterized to identify the antifungal compound the plant has produced. This will improve understanding of the defenses of wild blueberry and other Ericaceous species. In the future, we can examine which growing conditions in the field increase these compounds and what their effects are on managing disease levels.

840. The Perceptions and Reactions to Messaging on Browntail Moth Mitigation Among Mainers

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): McK Mollner, Devin Rowe, Angela Mech,

Faculty Mentor: Mario Teisl

Abstract: Current understanding of public perceptions of the environmental and human health risks associated with Browntail moth (BTM) is limited, yet the current BTM outbreak is a pressing issue in Maine. BTM is an invasive species that experiences cyclical population outbreaks. The current outbreak affects a larger portion of Maine and is on a larger scale than the 1990's outbreak. BTM is considered a pest because the caterpillars shed fine toxic "hairs". These hairs are microscopic, and may cause rash and respiratory distress. The caterpillar also gregariously feeds on trees causing tree stress which may lead to tree death. As BTM continues to outbreak in Maine, the disruption they cause to Mainers' lives has increased.

While there has been substantial literature investigating citizen willingness to finance solutions to other environmental issues, the ongoing BTM outbreak has yet to be thoroughly investigated. In this research we plan to ask three key questions to assess Mainers' willingness to contribute towards programs that may fund BTM infestation mitigation and management:Is the application method and application type important in making contribution choices, and willingness to participate in mitigation programs? To investigate this, we have designed a mixed mode survey that a sample of 10,000 Maine households in areas of BTM infestation will receive in Summer 2023. We hope to use the results to better understand Mainers' concerns about BTM, what mitigation strategies they support to better inform policy, and to help guide future BTM research and potential public outreach.

841. Life Experiences of College Students who Resided with a Parent Experiencing Depression

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Jasmine Olshin

Faculty Mentor: Mary Tedesco-Schneck

Abstract: Depression is one of the most prevalent mental illnesses in the United States. The life implications for the children of depressed adults have been studied, and this experience has been shown to yield negative outcomes in terms of being at risk for not having needs met, having less success in school, and being predisposed to experiencing depression themselves. As these children and adolescents grow and develop into young adults, many choose to attend higher education and leave the home in which they resided with a parent experiencing depression. Research pertaining to this age group and their life experiences is very limited. This study will aim to address this gap in literature by attempting to understand the experiences of first-year undergraduate students who lived with a parent with depression for at least five years prior to enrolling in college. An anonymous, online survey will be administered at the end of March 2023 to address questions pertaining to students' perceptions of their life experiences before and after transitioning to the college setting. This study has received final approval from the Institutional Review Board to begin in April 2023 and is expected to be defended as an Honors Thesis in September 2023.

842. University Students' Experience with Primary Care (PC) during their High School (HS) Years and the Impact on Transition to Adult PC.

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Grace Finley

Faculty Mentor: Mary Tedesco-Schneck

Abstract:

Focus: PC is associated with positive health outcomes and reduced costs. Estimates of adolescents who transition from pediatric PC to adult PC is low; yet it is reported those who have positive experiences with PC are more likely to access PC as adults. Studies describing adolescents' HS experience with PC and how it affected transition to adult PC are lacking. The purpose of this study was to describe university students' experience with PC during their HS years and the impact on transition to adult PC.

Methods: This study is a descriptive, non-experimental design whereby students reported their HS PC experience and how it affected transition to adult PC once in college through an anonymous online survey. The survey included the Person-Centered Primary Care Measure and questions created by the principal investigator. Data were also collected from students without a PC in HS.

Results: 210 participants received PC in HS, 16 did not. Reasons for lack of PC included no local PC sites (31%), family did not believe in PC (18%), and no health insurance (18%). In lieu of PC, urgent care was ranked as 1st and 2nd choice (100%), emergency room care 2nd and 3rd choice (78%), and school health center 3rd choice (53%). Participants who received PC reported easy access to care (92%). Only 66% reported the primary care provider (PCP) knew them as a person, 67% felt the PCP would stand up for them, and 48% felt the PCP had knowledge of their community.

843. Monitoring Eastern White Pine Health by Using Remote Sensing Assessment of Foliar Traits

Submission Type: Sudan Timalsina

Submission Category: Natural Sciences

Author(s): Sudan Timalsina

Faculty Mentor: Parinaz Rahimzadeh-Bajgiran

Abstract: A crucial component of Maine's economy and culture, Eastern White Pine (Pinus strobus) remains a significant species for the forest products industry of the Northeastern United States. A fungal disease complex known as White Pine Needle Damage (WPND) which has been on the rise over the last two decades poses a serious threat to the health and longevity of white pine. The precise time, extent, and severity of the annual WPND at a landscape level, as well as the impact of repeated defoliation caused by WPND on eastern white pine and forest health in general, are poorly understood. Although targeted silvicultural treatments can help mitigate WPND, identifying the outbreaks early on is of utmost importance to mitigate the damage caused by WPND. Using remote sensing techniques could potentially help us in early detection of WPND and provide an advantage over the traditional methods of data collection in the field. The ability of remote sensing tools to collect data on a large scale along with the evolving nature of the technology makes it promising for mapping out WPND however, the applicability of remote sensing techniques is largely unexplored. We want to use remote sensing techniques in combination with field data that we collected to estimate leaf traits such as nitrogen, chlorophyll and water content in Maine forests and potentially identify spectral differences in these traits between infected and healthy stands at the leaf level and ultimately upscale the findings to map WPND for larger areas.

844. Assessment of the Association of Sea Scallop Larvae Mortality and Vibrio spp. in Hatchery Systems

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sydney Shair, Keagan Rice

Faculty Mentor: Jennifer Perry

Abstract: Atlantic sea scallops are marine bivalves found on the northeastern coast of North America with increasing economic significance. Aquaculture is an alternative to wild harvesting to meet market demands. Hatcheries are currently faced with high larval mortality rates. Research into other aquacultured species suggests bacterial infection with vibriosis as the primary culprit. This is not currently validated in Atlantic sea scallops.

This project evaluates the presence of pathogenic Vibrio spp. in sea scallop hatcheries along the Atlantic coast. This is important because it serves to identify the source of the loss of larvae in hatchery systems.

Samples were collected from 3 sea scallop hatchery facilities from veliger, wild larval, hatchery larval, biofilm, and clean tanks. Swab samples (n=153) were plated on selective media for morphological identification. Each sample colony will be subjected to DNA extraction following the Dnase PowerFood protocol and will then be subjected to PCR using 15 different Vibrio genus and species-specific primer pairs. Gel electrophoresis will be run on amplified DNA templates to confirm the presence of Vibrio spp.

Veliger, wild larval, hatchery larval, and biofilm media plates showed 2 distinct colonies of morphological resemblance to Vibrio spp. It is anticipated that the PCR results of this project will better map out the presence of Vibrio spp. and their morphologies.

Confirming samples as Vibrio spp. will serve as a stepping stone in mitigation against the possible pathogens hindrance of Atlantic sea scallop rearing. These isolates will also be used for controlled scallop hatchery-related research projects.

845. Heat Shock Protein analysis in Soft Coral Xenia spp

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Claire Ittleson

Faculty Mentor: Ian Bricknell

Abstract: Mass bleaching events are one of the most serious issues facing coral reefs. A coral bleaching event typically leaves large percentages of both soft and hard corals damaged or dead. Less commonly known is how vacant reef sites are re-colonized by other corals after these events. The first corals found to resettle on dead or damaged reefs are typically the soft octocorals, such as Xenia sp.. These corals grow in large colonies. The rapid growth of these corals prevent the settlement of the slower growing stony corals following a bleaching event, which can delay the re-building of coral reef structure. Often, the soft corals grow on the dead skeletons of stony corals preventing hard coral larvae from settling on the dead reef. This study will investigate the molecular processes that play a role in the survival of Xenia sp. in conditions that are detrimental to many stony corals that contribute to a healthy coral reef ecosystem. By examining the expression of heat shock proteins in Pulsing Xenia, a start can be made to understanding why these soft corals are able to endure and recover quickly following mass bleaching events, and potentially inhibit the recolonization of a damaged reef by stony corals.

846. Protein Concentration in Sea Lice Hemolymph

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Madeline Abell

Faculty Mentor: Ian Bricknell

Abstract: Sea Lice (Lepeophtheirus salmonis) remain the most significant economic loss to salmon farming today and the largest economic loss to aquaculture worldwide. However, little is known about sea lice physiology. Sea lice are known osmoconformers, keeping their hemolymph (blood equivalent) at the same salinity as seawater. In this study, hemolymph samples were collected in glass microneedles and analyzed via PAGE electrophoresis gels. It is currently unknown if sea lice use hemoglobin or hemocyanin to transport oxygen around their bodies. This study aimed to determine which of these two proteins sea lice use for oxygen transport by running standard proteins with the range of molecular weight covering the molecular weight range of hemoglobin. We identified a protein cluster in sea lice hemolymph that matched the molecular weight of salmon and human hemoglobin. The presence of hemoglobin was confirmed with a dedicated hemoglobin assay, and it was discovered that hemoglobin makes up about 40% of the total protein of the hemolymph. This is a unique finding, as hemocyanin was believed to be the primary protein involved in oxygen transport in sea lice before this study. The presence of hemoglobin proteins may allow the development of novel vaccinations for controlling sea lice or identifying how sea lice tolerate low-oxygen environments, such as during a lice treatment phase on the farm.

847. An In-Depth Literature Review Proposing Possible Solutions to Reduce Nutrient Runoff and Soil Erosion Along Maine Shorelines Using Wild Blueberry Rhizomes and Biochar

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ava Ardito

Faculty Mentor: Yongjiang Zhang

Abstract: Nutrient runoff and soil erosion along Maine's shorelines have been a crucial problem that many Maine communities are trying to prevent. Nutrient runoff carries excess nutrients from the soil into waterways detrimentally harming these ecosystems. Wild blueberry plants established through their strong underground rhizomes are an abundant native resource to Maine that grow in the barrens and along the shorelines of Maine. Wild blueberries are both economically and culturally important to Maine and have proven to be a resilient and low-maintenance crop in Maine's rugged environment and changing climate. Additionally, UMaine researchers are studying a new sustainable material called biochar and using it in wild blueberry soil to study water retention capacity. Biochar is a sustainably made charcoal-like material with a potential of improving soil water holding capacity and reducing soil erosion. The combination of wild blueberry plants and biochar have the potential to reduce nutrient runoff and stabilize eroding shorelines to improve the health of Maine's aquatic ecosystems. Through reviewing a multitude of studies covering the impacts of nutrient runoff and soil erosion along Maine shorelines, it can be concluded that wild blueberries and biochar have a promising potential to be used as a sustainable soil amendment for reducing nutrient runoff and soil erosion along Maine shorelines. It was also found that Maine shoreline communities are in search of conservation landscaping tactics that will prevent nutrient runoff and soil erosion in their waterways, and prevent the reduction of economic growth. Further research through an experiment is needed to determine the validity of this amendment. However, the research conducted justifies the need for a sustainable solution to nutrient runoff and soil erosion and the conduction of further experimental studies to demonstrate if this amendment works in applied conditions.

848. Characterizing White Catfish Movements in the Penobscot River

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Andrea Casey, Matthew Mensinger

Faculty Mentor: Joseph Zydlewski

Abstract: White catfish (Ameiurus catus) are native to Atlantic coastal rivers from Florida to New York but have been introduced to more northern rivers. In 2007, this species was first reported in the lower Penobscot River in Maine. The removal of two main-stem dams in the Penobscot River has improved connectivity for native migratory fishes, while also allowing for potential upstream movement of non-native white catfish. The movement of these invasive fish has been discouraged by Maine Department of Marine Resources through removal at the lowermost Milford Dam. It is unclear if catfish encountered at the dam are the result of short distance movements of local catfish, or long-distance movements. To inform management, we angled white catfish downstream of the Milford Dam in July (2022) and surgically implanted them with acoustic tags (Inovasea V9). The movements of these tagged fish are being assessed using both active and passive tracking. This project employs 30 fixed acoustic receivers over 50 km of river (from upstream of the Milford Dam to Bucksport). Data collected in the fall revealed long distance (>10km), repeated movements of several tagged fish, possibly linked to tidal patterns. Data gathered from receivers in spring will be used to construct annual movement patters for each of the 10 tagged fish. Understanding the movements of white catfish in the Penobscot River will aid management efforts by informing potential spatial overlap with native fish species.

849. An Examination of the Risk Factors that May Make High School Students More Susceptible to Lyme Disease Exposure

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Willow Throckmorton-Hansford

Faculty Mentor: Allison Gardner

Abstract: The intertwined effects of biological and social factors recently have led to a dramatic increase in Lyme disease cases in Maine. These factors include environmental exposure to ticks, a lack of knowledge of prevention measures against ticks, and an increasing population of blacklegged ticks throughout the state. Although this is an issue that affects people of all ages, research involving examination of risk factors and educational outreach primarily focuses on elementary school students. High school students have been seldom used as a group of interest involving Lyme disease prevention research, yet they may be exposed to ticks while engaging in extracurricular activities, outdoor recreation, and in-class lessons that occur outdoors. In addition, biological and social factors contributing to this issue have never been investigated in tandem in the context of a high school population. Using a multidisciplinary approach, this research sought to determine the differing risk factors contributing to Lyme disease exposure between rural and urban high school students. I hypothesized that an examination of the attitudes, practices, and social factors would show that rural high school students are less likely to take preventative measures against Lyme disease exposure and are more likely to visit areas with large blacklegged tick populations and high Lyme disease occurrence, compared to students from urbanized communities. This research will serve as a springboard for targeted Lyme disease education among high school students.

850. Sea Lice Survival Curve Study

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Faith Flynn

Faculty Mentor: Ian Bricknell

Abstract: Sea lice (Lepeophtheirus salmonis) are one of the most pervasive marine parasites found within aquaculture settings. Infections negatively impact the health of fish, impose additional costs related to treatment, and reflect badly on the salmon farming industry as a whole. While conducting experimental trials with sea lice and salmon at The National Cold Water Marine Aquaculture Center USDA facility in Franklin, Maine, it was found that sea lice were recirculating within the system. It was originally presumed that the copepodids were surviving the extreme pressures of the circulatory pump and recirculating through the system. It is now thought that the sea lice may be surviving in the chiller pump instead, where the pressures are less great. Using nets to capture sea lice as they recirculate, counts will be conducted in a mock-flume system using a small aquarium pump. Data collected will be used to assess the risk of recirculation of sea lice within a small system. Determining copepodid survivability over time will be beneficial in preventing sea lice transmission. This baseline data can serve as a model for which more effective preventative measures can be designed or improved. Research into how competition, temperature, and other factors affect the survivability and success of sea lice within a system can be conducted to further our findings.

851. Ice Core Measurements and Glacial Temperatures

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Michael Goodwin

Faculty Mentor: Karl Kreutz

Abstract: Ice cores are used to measure different properties of glaciers. These measurements give insight into past climate characteristics. Typical measurements include visual stratigraphy and density of the ice core, as well as temperature measurements of the boreholes (between 10 and 20 meters). These will be basic measurements performed on the ice cores drilled at Divide Icefield located at Kluane National Park, Saint Elias Mountains, Yukon. The data we obtain in 2023 will be compared to previous data that has been collected in the local area (Grew and Mellor 1966). The mean annual air temperature of 2023 of the borehole will be compared to that of the mean temperature of the summer of 1964 (from Grew and Mellor 1966). These observations will show if there is any warming between the 60s and 2023. We anticipate that these observations will highlight some of the properties of the glacier that contribute to glacial melting. The comparisons of the mean annual temperatures of the Divide glacier will provide insight into how this glacier is changing over time and how rising global temperatures will affect the inner glacial temperatures.

852. The Effects of Temperature and Acid Pretreatment on the Shelf Life of Sous Vide Processed Mussels

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sara Gundermann

Faculty Mentor: Denise Skonberg

Abstract: The primary objective of this research is to investigate the effects of processing temperature (65°C or 75°C) and lactic acid pretreatment (0, 0.5, or 1%) on the quality of sous vide processed mussel meats. Sous vide cooking is a commercial processing method in which the raw food is placed in a pouch, vacuum sealed, and cooked in water below 100 degrees Celsius. There is not much known about how sous vide processing impacts the shelf life of seafood products, specifically bivalves like mussels and oysters. The mussels were sous vide processed, stored under refrigeration (5°C) and then assessed for their physical, chemical, and microbial qualities at various time points. Aerobic plate counts, thiobarbituric acid reactive substances (TBARS), total volatile base nitrogen (TVB-N), pH, and liquid loss were determined through standard methods. Instrumental color was evaluated using a Hunterlab colorimeter to determine L*a*b* values, and instrumental texture was performed by using a TA-XT2i texture analyzer. The effects of independent variables will be analyzed statistically with ANOVA. Chemical analyses are ongoing but physical analysis has suggested that mussel texture was affected by both temperature and acid pretreatment. All samples, regardless of processing temperature or acid concentration, did not last past 35 days of storage. This is the first study to report on impacts of sous vide processing on already-shucked mussel meats. The development of shucked, value-added mussel products would benefit Maine's sustainable seafood economy and make it more convenient for consumers to increase their consumption of healthy seafood products.

853. Reassessing the Presence of Tick-borne Bacterial Pathogens Transmitted by the Seabird Tick Ixodes uriae in Gulf of Maine Atlantic Puffin Colonies

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Joseph Cleaves, Alyssa Marini, Thomas Rounsville, Ann Bryant, Griffin Dill, Elissa Ballman

Faculty Mentor: Allison Gardner

Abstract: Ixodes uriae is a hard-bodied seabird tick that exploits colonial seabirds at high latitudes throughout the Northern and Southern Hemispheres. The seasonal inter-colony movements of seabirds, such as migration and prospecting, contribute to the dispersal of Ix. uriae. The pathogens carried and transmitted by Ix. uriae, including many of medical concern, are diverse due to the tick's host richness and broad geographic distribution. Previous studies detected no tick-borne pathogens in Ix. uriae collected from the Gulf of Maine's alcid colonies, but found Borrelia garinii, a causative agent of Lyme disease in Eurasia, in ticks from Atlantic puffin (Fratercula arctica) colonies in Newfoundland. The recent expansion of B. garinii in Newfoundland's colonies indicates the need for vector surveillance of Ix. uriae in the Northwest Atlantic, including the Gulf of Maine, the southernmost breeding range of the Atlantic puffin. With assistance from the Gulf of Maine Seabird Working Group and the UMaine Diagnostic and Research Laboratory, we collected Ix. uriae from five Atlantic puffin colonies in the Gulf of Maine and conducted qPCR pathogen analysis of collected ticks to determine the presence or absence of bacterial tick-borne pathogens. Our results represent the first record of Borrelia spp. and a Rickettsia-like organism detected in Ixodes uriae from the Gulf of Maine, building on the known distribution of these pathogens and necessitating future surveillance of these colonies.

854. Meltwater Accumulation in Firns and its Impacts on Human Populations and Ecosystems

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mackenzie Andersen

Faculty Mentor: Karl Kreutz

Abstract: Temperatures have been increasing in response to climate change, affecting glaciers and ice sheets globally. In response, positive feedback has formed between glaciers and the climate through recession and melting. The firn is the region of the glacier that is made up of partially compacted snow. It can retain a proportion of meltwater coming from the glacier and control the amount of melt going into the hydrologic reservoirs off of the glacier. However, as temperature increases so does the rate of melt which can impact ecosystems and human populations. Flooding can damage ecosystems and infrastructure in the area. Salmon populations can decrease from an influx of nutrients. Here I will show the accumulation of meltwater in glacial firns and future impacts on human populations and ecosystems in the St. Elias Mountain region. For my capstone project, I will measure and analyze the melt accumulation within glacial firns through creating a backlit snow pit, two pits about the size of an average person with a wall of snow in between them. One pit is lit up to see the layers in the snow wall. I will also be running a dye experiment, where I will put dye through the snow wall and analyze how water percolates through the firn. Along with this, I will be working on an article that entails the research I will be doing in the St. Elias Mountains as well as how the possible increase of meltwater in firns could impact human communities in the future.

855. Establishing Maine's Natural and Human Fire History

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Megan MacKay

Faculty Mentor: Jacquelyn Gill

Abstract: Charcoal from sedimentary lake records is used as a proxy to determine a chronology of wildfires for the surrounding areas. The Wabanaki people, indigenous to Maine, have oral records and knowledge about managing forested landscapes with fire over the past 10,000 years. However, the Indigenous use of fire as a landscape management tool has been contentiously contested. The different plants burned in the wildfires produce distinct charcoal morphotypes that get buried in the lake sediment over time. Currently, there have been no charcoal morphotype reference collections created for native Northeastern species. In this research, native Northeastern species, such as Fraxinus americana and Tsuga canadensis, were collected and burned to produce charcoal. Both different species and different parts of the flora produce distinct charcoal morphotypes. The different morphotypes could then be used to identify between genus of flora that were burned simply using the charcoal found in the sediments. Using this information, charcoal gathered from sediments can not only be used to determine the number and intensity of wildfires in the past, but also can be used to understand the ecological structure of the areas that were burned.

856. Chef Sensory Analysis of Fermented Green Crab Sauce

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Bryson McDonough, Mary Camire

Faculty Mentor: Jennifer Perry

Abstract: The European green crab (Carcinus maenas) is an invasive marine invader causing immense ecological and economic damage along the North American East Coast. Soft-shelled green crabs are a culinary delicacy, but the majority of green crabs are hard-shelled and possess very little value. Previous research has determined a safe fermented green crab condiment, in the style of fish sauce, can be manufactured. The primary objective of this research was to investigate chefs' liking of a newly developed, fermented green crab sauce.

To manufacture green crab sauce, green crabs were chopped, mixed with 20% NaCl, and fermented for 90 days. Following fermentation, the sauce was filtered and pasteurized.

The finished sauce was mailed to 24 New England-based chefs for at-home sensory analysis. Eighteen chefs evaluated the appearance, aroma, flavor, and liking of the sauce in a recipe compared to an umami enhancer of their choice on a 9-point hedonic scale. The chefs rated the appearance, aroma, and flavor 5.88 ± 1.53, 5.06 ± 2.22, and 7.06 ± 2.16, respectively. The overall acceptability of the green crab sauce and an umami enhancer of the chef's choice used in a recipe was rated 6.75 ± 1.95 and 7.50 ± 1.28, respectively; these values are statistically non-significant. The chefs also provided useful qualitative feedback. A fermented green crab sauce has the potential to create a high-value waste valorization for hard-shelled green crabs, allowing for economical large-scale capturing and population control of invasive green crabs.

857. The Effect of Salting and Brining on the Sensory Characteristics of Sugar Kelp (Saccharina latissima)

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Richa Arya, Mary Camire

Faculty Mentor: Jennifer Perry

Abstract: The growing demand for seaweed in the U.S. necessitates product development research to help the seaweed industry. This study investigated the effects of processing techniques- dry salting and brining, on the sensory characteristics of sugar kelp. Farm-raised kelp was washed in cold water to remove biofouling and was subjected to dry salting (30% w/w kosher salt) or brining (40% w/v NaCl brine, 1:4 ratio) treatments and stored at 4°C for 2 weeks before sensory evaluation. The day before sensory evaluation, salads were made with raw fresh kelp (control) or processed kelp (after rinsing), shredded carrots, sesame seeds, and sesame dressing. Participants recruited via email and social media (18 years and older) evaluated the three salad preparations for overall liking, saltiness, taste, smell, texture, and color using the 9-point hedonic scale. SIMS 2000 software was used to create the questionnaire and collect data. Analysis of variance with Tukey's HSD test was used for hedonic score analysis. Forty-one people completed the sensory evaluation of salad samples. The salad samples with fresh kelp were less liked than the samples with dry-salted or brined kelp for texture, flavor, and overall liking ($p \leq 0.05$). No differences in liking were found for appearance, aroma, or saltiness. The salted kelp salad's color was more liked than the control's. The overall liking mean was 5.0 for the control and 6.2 for other treatments. Salting and brining can be used by seaweed growers to produce sugar kelp-based products with improved shelf life.

858. Interlaboratory Calibration for Laser Ablation of Ice Cores

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Lela Gadrani, Elena Korotkikh, Pascal Bohleber, Paul A. Mayewski, Michael Handley

Faculty Mentor: Andrei Kurbatov, Paul A. Mayewski

Abstract: Only a few published ice core laser ablation studies reported concentrations of impurities in ice cores. Two major barriers are: a) A complex interaction of the laser beam with the ice surface and b) An availability of homogeneous ice core standards with known concentrations of impurities. In this study we evaluated the applicability of new methods for producing artificial ice standards for calibration measured frozen ice core samples using LA ICP MS instrumentation. We adapted a methodology developed in the laboratory at Ca' Foscari University of Venice. Developed standard preparation method is relying on rapid chilling of several known standard solutions using liquid nitrogen. A commercially available "Multielement solution 2A" (5% HNO3) was diluted in Milli-Q water 5 ml samples with concentrations, 20 ppb, 60 ppb and 100 ppb. Frozen surface was pre-cleaned with a clean ceramic scraping tool inside of a -24°C clean cold room to avoid contamination on the surface during the sample preparation. Developed artificial ice standards with different concentrations of Na, Ca, Al, and Pb were measured frozen inside of UMaine Keck LA-ICP-MS 1 m long cold chamber. During the data reduction phase, the first 8 seconds of measured background were removed. We also removed signal washout time and calculated the mean value of the signal for 50 seconds of ice ablation. We use exponential regression fit to calibrate signal intensities to the corresponding sample concentrations. This work will help to measure and interpret an ultra-high-resolution signal of very old and highly compressed ice core records from the Allan Hills Blue Ice Area, Antarctica.

859. Greenhouse Quantification of Resistance to Potato Blackleg and Soft Rot in a Caribou Russet

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Daniel Balderrama

Faculty Mentor: Ek Han Tan

Abstract: In 2015, an outbreak of the disease potato blackleg and soft rot (PBSR) swept across Maine, causing significant losses to the state's potato industry. One of the causal agents for this outbreak appeared to be Dickeya dianthicola, a necrotizing soil bacteria that is a pathogen of many important crop plants. The potato industry in Maine is valued at $200+ million dollars per year, and is one of the largest producers of seed potatoes sold to other states. Thus, protecting this industry is vital for the health of Maine’s agricultural sector.

My research focuses on identifying quantitative trait loci (QTLs) for PBSR resistance in Caribou Russet, a potato variety that was released by the University of Maine breeding program. There is anecdotal evidence that this variety has resistance to PBSR, though the genetics behind this have yet to be described. Using a combination of direct bacterial injection and vacuum inoculation, I will perform phenotyping assays to quantify PBSR resistance in a dihaploid population derived from Caribou Russet. Subsequently, field trials will allow me to show support for my findings in a real world setting. This work may lead to the development of DNA markers that can be used to screen for PBSR resistance in future breeding efforts, thereby providing farmers with improved potato varieties, and reducing economic losses from future outbreaks.

860. Soft-shell Clam (Mya arenaria) Recruitment in the Damariscotta River Estuary

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Annapurna Leung

Faculty Mentor: Heather Leslie

Abstract: Soft-shell clam (Mya arenaria) is an important fishery in Maine. Knowing how soft-shell clam populations change and why is essential to effective management. Studying the recruitment of juvenile soft-shell clams to the mudflats provides information that local resource managers can use to assess the health of the soft-shell clam populations. In this study, we asked three questions: How does clam recruitment vary through space and time? What is the size structure of clam recruits? and Is there any connection between the magnitude of clam recruitment and green crab abundance? Data were collected from the Damariscotta River Estuary at two sites: Chadbourne and Lowes Cove. At each site, we deployed boxes to assess clam recruitment in the absence of predation. We also collected a sediment core adjacent to each box, to assess recruitment under natural conditions. We found that Chadbourne had significantly more soft-shell clam recruits than Lowes Cove. We also observed a trend towards more predators, i.e., green crabs, at Lowes Cove. Data also were compared among two years to trends through time. Future research could focus on ways to mitigate the impacts of green crabs and other predators on clam recruitment to ensure that these shellfish populations are able to thrive into the future and generate both economic and culture value to nearby coastal communities.

861. Exploring Plot and Sampling Design in Enhanced Forest Inventories (EFI) in Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Rissa Currie

Faculty Mentor: Aaron Weiskittel

Abstract: The focus of this project is to develop a model to compare circular versus square, fixed radius plots and overall sample design with airborne laser scanning data to map Enhance Forest Inventory variables. Interest for this arises from the thought that square plots will complement the square pixels being observed and has not been tested in the northeast forest type. Locations for the project include the Penobscot Experimental Forest in Bradley, Maine and the Dwight B. Demeritt Forest in Old Town, ME. Methods for this project include creating plot summaries from the inventory data for basal area (m2/ha), stem density (#/ha), volume (m3/ha), and percentage of softwood. Circular plots had a 10 m radius, while the square plots were clipped to maximum size within the circle. In order to get the tree summaries for the square plots, trees were stem mapped using R statistical software and then clipped. Sampling designs for these plots include random and stratified. Expected outcomes based on scientific studies suggest there may not be much difference between the two plot designs and due to the practicality of field inventory, circular plots would be the best choice. For sampling design, the stratified is most likely to perform just as well if not better than the random sampling method, which would be important as it can improve the field inventory collection.

862. Abundance of European Green Crab, Carcinus maenas, at sites throughout the Damariscotta River Estuary

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Matthew Yost

Faculty Mentor: Heather Leslie

Abstract: Seafood is one of the leading industries within Maine. Of the many seafood species which Maine harvests, the soft-shell clam (Mya arenaria) is one of the most recognizable and widely consumed species. The European green crab (Carcinus maenas) is one of the top predators of softshell clams. Since introduced to Maine waters in the 1800s, green crabs have greatly impacted local ecosystems and fisheries. The Damariscotta River Estuary has seen a drastic decline in soft-shell clam populations and a concurrent increase in green crabs. This study investigates the abundance of green crabs at three sites within the estuary across multiple seasons of two years (2021 & 2022). Our goal was to study how the abundance of crabs varied and possible associations with environmental factors. We observed higher abundances of crabs in the summer and at sites with ample algal or rock cover. With warming temperatures in the Gulf of Maine, green crabs likely will continue to be a challenge to sustaining soft-shell clam populations and other components of Maine marine ecosystems.

863. Prey Preference in Hemigrapsus sanguineus, Carcinus maenas, and Cancer borealis

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Madeline Williams

Faculty Mentor: Brian Beal

Abstract: On the coast of Maine, the invasive green crab, *Carcinus maenas*, competes directly with the invasive Asian shore crab, *Hemigrapsus sanguineus*, and native Jonah crab, *Cancer borealis*. *Carcinus*'s high consumption rate of prey, molecular plasticity and increasing populations make them dangerously successful. We studied prey preference and magnitude of consumption in each crab species to better understand factors affecting Maine's intertidal ecosystem. Each of ten juvenile soft-shell clams (9-18 mm SL), *Mya arenaria*, and blue mussels (9-18 mm SL), *Mytilus edulis*, were acclimated in five fish totes with and without sediment. One crab was introduced to each tote and then removed after 6 hours. Prey preference was assessed using chi-square tests of independence. Regardless of sediment (±), *C. maenas* preyed more heavily (by 18-34%) on *M. edulis* than similar size Hemigrapsus; however, no differences in consumption rates of *M. arenaria* were observed between crab species. Approximately 50% of *M. arenaria* were consumed by *C. borealis* independent of sediment treatment, whereas *M. edulis* were preyed on more heavily when sand was present (57%) vs. absent (32%; $P = 0.0004$). Pooling data across sediment treatments, small *C. maenas* preyed on significantly fewer *M. arenaria* (32% mortality) than the medium and large *C. maenas* (69% mortality; $p<0.0001$). The common theme was how aggressive *C. maenas* was compared with other crab species. Building these predator profiles will aid in understanding how population shifts of each of these crab species could impact bivalve communities.

864. Holocene Clime Variability Using Pro Glacial Stumps

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Tahiris Ruiz

Faculty Mentor: Aaron Putnam

Abstract: Understanding past glacial behavior can help provide context to current glacial recession in response to warming temperatures. Here we report a pilot data set that records past fluctuations of glaciers in Southeast Alaska. In May of last year, our field team collected sub-fossil wood samples from the forelands of two outlet glaciers of the Juneau Icefield: the Mendenhall and Herbert Glaciers. We collected an array of samples from glacially sheared in-situ tree stumps and transported wood pieces. Results from radiocarbon dating of these wood samples indicate glacial advances within the last millennium including advances up to 4,000 years ago.

Since our last visit in 2022, the terminus of the glacier has retreated and exposed new terrain. This coming summer, we hope to collect more samples for radiocarbon dating from recently exposed terrain and continue to examine the relationship between glacier fluctuations and temperature changes.

865. Determining the Ice Extent of a Firn Aquifer on the Kaskawulsh Glacier, St. Elias Mountains, Yukon, with Ground Penetrating Radar

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Zoe Olson

Faculty Mentor: Seth Campell

Abstract: An aquifer is liquid water that can exist in firn or snow of a glacier system. Firn is granular multi-year snow that has not been compacted into ice, and has persisted for many years without melting. Liquid water can reside in snow, firn, or ice; but because firn is more porous this is where aquifers tend to be found. Liquid water can have significant effects on glacier dynamics due to changes in hydrology, but glacial aquifers is an area of study in glaciology that is poorly understood especially in temperate locations in regards to extent and thickness. However, the size and location of these aquifers can lead to an impact to the temperature of the glacier; disrupt the snow-to-firn-to-ice process; or cause increased velocity when the aquifers drain and lubricate to reduce basal friction of the glacier.

Firn aquifers can be measured using ground penetrating radar (GPR), borehole studies, or dye tracer tests. In Kluane National Park on the Kaskawulsh glacier, we will attempt to relocate an aquifer found in 2016, using a 400 MHz GPR. This system will provide observations of shallow stratigraphy including any evidence of an aquifer. The aquifer extent and thickness in 2023 will be compared with GPR results acquired in 2016. The goal of this project is to determine whether this aquifer is still present, and to categorize its behavior as perennial or persisting.

866. The Implementation of a Gauge Station at Ayers Island on the Penobscot River

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Hayden Libby, Cade King, Lauren Ross, Joe Zydlewski, Bea Van Dam

Faculty Mentor: Sean Smith

Abstract: The purpose of installing a gauge station at Ayers Island on the Penobscot river was to create a record of freshwater input to Penobscot Bay from the river. To install the gauge station: bathymetry of the river and flows were collected, and models were done to predict what the flow of the river was at different stages. This resulted in having a rating curve specific to the installed pressure sensor on the island. The pressure sensor sends the river stage to an online database that can be downloaded and run through the rating curve to determine flow. The main results of this project were the creation of a gauge station. The next steps are to collect more flow data to increase the accuracy of the station and to create a public access point to the flow data.

867. Establishing Trail Signage at the Newman Hill, Orono Land Trust Property

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): William McPhee, Eva Popov

Faculty Mentor: Jessica Leahy

Abstract: In collaboration with the Orono Land Trust, we worked on the Caribou bog conservation area in Orono, Maine to map out, design, construct, and implement a series of educational signs along a 0.8-mile loop trail near Newman Hill in the southwestern corner of the town. Signage along the trail was written to be read and understood by an audience of elementary-school-aged kids or older. Signs highlight natural features such as wildlife habitat, keystone species, native traditional knowledge, native plant species, and other land uses. To construct these signs, the base design consisted of a wooden base plate upon which a laminated piece of paper containing the sign information was stapled. Depending on the location of the sign's placement, a wooden pole might be used in the case that a natural feature wasn't present for the sign to be attached to. Upon conclusion of the project, visitors of all ages to the Orono land trust should be able to readily understand and gather information from the signs regarding local ecology and land history.

868. Expression of the RAG1 Gene in Larval Yellowtail

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Gabriella Peluso

Faculty Mentor: Timothy Bowden

Abstract: Aquaculture has taken over from capture fisheries as the primary global provider of seafood products. Seriola lalandi, or Yellowtail kingfish, has become a species of interest, as it is a fish notable for its marketability and culinary desirability. With the expansion of aquaculture and the increased amount of high-level operating facilities, comes the increased risk of disease outbreak. There are methods commonly used within these facilities as means of disease control, including incorporating nutritional feeds into the fishes' diets, safe husbandry practices, and vaccinations. While these methods can be effective, they do have caveats that must also be considered. Adequate diets and improved husbandry techniques are only preventative measures of disease contraction, and vaccinations must be administered properly to ensure adequate efficacy. Timeliness of vaccination regimes during larval development is especially important, as to avoid tolerance and ineffectiveness of the vaccine, and to promote the survival of fish in their earlier, more vulnerable stages of development. Previous literature has investigated the early development of the immune system in larval stages of many species through the expression of the RAG-1 and RAG-2 genes. These genes have been shown to be indicators of physiological maturity of the immune system, playing an important role in the differentiation of B- and T-cells, both crucial for immune response. For this project, RNA was extracted from larval Yellowtail kingfish tissue samples, the samples ranging from 0 to 25 days post hatch (DPH). The RNA was then converted into cDNA through reverse transcription, and qPCR was conducted to quantify gene expression, using the Ct method, at the selected developmental time points. Between these two time points, there was no significant peak in expression of the RAG-1 gene, indicating that there is a possibility that RAG-1 expression may happen later in the larval development of Yellowtail kingfish, or there is no identifiable peak in its expression during development. More studies involving tracking the expression of genes associated with immune development in farmed species are incredibly important for the prevention of disease within aquaculture operations, assessing human health risk of consumption depending on pathogen exposure, and the continuity of aquaculture and food sourcing.

869. Yellowtail Kingfish Larval Immune Development

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Lingzi Ding

Faculty Mentor: Timothy Bowden

Abstract: Aquaculture is the best alternative to relieve the stress of the alarming declines in wild fish stocks worldwide and meet the growing demand for food consumption. Yellowtail kingfish (Seriola lalandi) is an ideal aquaculture candidate species currently being developed for commercial production, and production facilities are being developed in the Northeastern United States. However, the aquaculture of yellowtail kingfish faces difficulty dealing with the high mortality problem during larval rearing stages in hatcheries. The bottleneck may, in part, be due to the larvae's undeveloped immune system. Therefore, we want to investigate the species-specific larval immune function development to optimize the hatchery management strategy and improve the larval survival rate.

This project aims to investigate the larval immune development of yellowtail kingfish and build an immunological development timeline. At each early developmental sample point, functional assays will be used to detect and quantify different immune functional proteins, such as lysozyme, α2-macroglobulin, classic and alternative complement pathways, and antibodies. To track immune system development, the development of immune organs, such as the thymus, will be investigated by immunohistochemistry. qPCR and in situ hybridization will be utilized to probe larval tissue for expression of immune genes such as IgM, C3, TCR α/β, and C-reactive protein. In addition, a practical experiment will be conducted to monitor how larvae will respond to vaccination, and yellowtail kingfish blood cell differentiation will be explored as background knowledge of its immunology.

870. Development of Methods to Determine the Enantiomeric Excess of Lactic Acid in Biphasic Solutions

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Marissa Smith

Faculty Mentor: Brian Frederick

Abstract: Polylactic acid (PLA) is a glucose-based, biodegradable, recyclable, and thermoplastic polyester. Current production of PLA is based on the fermentation of sugars to produce the monomer, L-lactic acid. The L- and D- enantiomers are difficult to differentiate from one another as they have very similar physical properties. The production of D-lactic acid itself is expensive and few microorganisms produce it. We have shown that lactic acid is produced from glucose over m-WO3 catalysts under biphasic conditions, which offers an alternative, potentially economically favorable way to produce PLA on a large scale. Whether the lactic acid produced is selective for the L- or D-enantiomer is not clear. Heterogeneous enantioselective catalysts are rare, so if the m-WO3 catalyst is enantioselective there is fundamental interest and practical value for production of D-lactic acid.

We investigated mainly GC/MS methods to determine the enantiomeric excess of lactic acid. Chiral derivatization was performed to form a diastereomer and analyzed by conventional GC/MS. We have derivatized lactic acid standards using L-menthol to form diastereomers, based on previously published methods and analysis with GC/MS on an Rtx-5ms column. The L- and D-lactic acid derivatives of L-menthol were separated and identified using GC/MS. The reaction product mixture contains 1-butanol as the organic component of the biphasic reaction, as well as glucose, fructose, formic acid, and water. A mock product solution was derivatized and the L- and D-lactic acid derivatives of L-menthol were identified.

871. Comparing the Diversity of Ectomycorrhizal Fungi Between Coastal Maine Islands Varying in Size

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Evan Warburton

Faculty Mentor: Peter Avis

Abstract: Mycorrhizal fungi form symbiotic relationships between trees by connecting to tree root tips and exchanging essential soil nutrients for carbon. In this project the mycorrhizal communities of six coastal Maine islands are being assessed and compared using molecular ecology techniques including DNA based metabarcoding of tree root tips and soil samples, and bioinformatics to identify and compare members of the ectomycorrhizal fungal communities on each island. Preliminary data analysis has produced a total of 4,605 unique ASVs (amplicon sequence variants) across all islands, as well as each island having a different composition of ectomycorrhizal fungi. Further comparisons are being conducted to assess how diversity differences between islands relate to factors such as island size. Comparing the mycorrhizal communities of these islands will lead to conclusions on the impacts of island geography on island forest health and ultimately better our understanding of how varying degrees of mycorrhizal fungal diversity impact forest ecosystems.

872. Exploring Patterns between Annuli Growth of Wood Turtles (Glyptemys insculpta) and Past Weather Conditions

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Hunter Praul

Faculty Mentor: Matthew Chatfield

Abstract: Annually deposited growth rings, also called annuli, may result from hibernation, dormancy, or other seasonal interruptions in growth. Although relatively uncommon in nature, they are present in a wide variety of organisms, such as trees, some bones, turtle shell scutes, and fish fin spines. Turtles in northern latitudes exhibit annuli on their shells with each ring representing one year of growth. In this study, I measured plastron (lower part of the shell) annuli widths of 20 different wood turtles (Glyptemys insculpta), assigned years to each ring, and compared them to each other, past weather data, and across sampling locations. Study photos were selected from a bank of candidate photos of many individuals taken in 2021 and 2022, and photos with the clearest annuli were chosen for analysis. Despite a strong correlation among annuli widths within individuals, there is substantial variation across individuals, suggesting an animal's growth varies by year somewhat independently of others. Patterns of annual growth across individuals may correlate with weather, but the association is weak. There also appears to be no correlation between sampling sites. Further research should include more turtles over longer time periods in order to better understand variation in growth patterns among individuals and reduce error in assigning years to annuli.

873. Utilizing Ground-Penetrating Radar to Determine Ice Thickness of a Firn Aquifer on the Kaskawulsh Glacier, St. Elias Mountains, Yukon

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Shannon Thompson

Faculty Mentor: Seth Campbell

Abstract: Glacial ice forms from accumulation, starting as snow, granular ice, firn, then glacial ice. Firn aquifers are areas in glaciers where liquid water is stored. 10 MHz and 100 MHz common offset ground-penetrating radar (GPR) will be used to image the extent and thickness of a firn aquifer found on Kaskawulsh Glacier, Yukon in 2016. Radar (Radio Detection And Ranging) sends out electromagnetic pulses through ground and snow. In common offset GPR, the distance between the transmitter and a single receiver are fixed readings. GPR displays profiles that are able to detect ice thickness and will be used to determine the extent of the firn aquifer. Proxies of water retention in glaciers are observed through firn aquifers within the ice. The aquifer potentially increased, decreased, or remained constant in size from 2016 to 2023. The dynamic changes of the firn aquifer will be observed by common offset GPR in this study. Observing the firn aquifer creates less reflectivity back from additional features and allows for further readings utilizing less energy/power. Using common offset GPR will be useful in determining the ice thickness and ice extent of the glacier. The results created from this radar profile will display a shrinkage, expansion, or disappearance of the aquifer. The questions reproduced from these results will help to further our understanding of firn aquifer residence time in the Yukon region. Searching for more aquifers and observing their changes in the region works towards determining the stability of the ice field and surrounding region.

874. Atlantic Sea Scallop (Placopecten magellanicus) Immune Ontogeny and its Relevance to Hatchery Survival Rates

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Nichole Blackmer

Faculty Mentor: Timothy Bowden

Abstract: To meet the increasing demand of scallops in the U.S., Atlantic sea scallop (Placopecten magellanicus) farming is on the rise. Farmers rely on the acquisition of wild spat to populate their farms, however the wild supply is inconsistent. Hatcheries in Maine are attempting to produce a consistent spat supply, but they experience sudden mass mortalities of larval scallops with unconfirmed causes of mortality. Sea scallops have a long larval period and are vulnerable to infections during these stages. The larval stages through settlement are a crucial time for development, especially the immune development, as demonstrated in other bivalves. There is currently a lack of knowledge concerning the sea scallop immune system, particularly during the larval stages. Research on sea scallop immune ontogeny and immunocompetence can provide insight into underlying reasons behind the mass moralities and what types of immune functions protect the larvae during certain stages. This project seeks to understand the immune ontogeny and immunocompetence of sea scallop larvae through gene expression analysis of immune markers and its relevance to larvae survival in hatchery hatcheries. This poster will focus on the methodology used including RNA extraction, primer design, and polymerase chain reaction (PCR). It will also include major complications encountered thus far. This study and methodologies contribute to the information on the basic biology and immune ontogeny of the sea scallop.

875. The Use of Probiotics to Counter Vibriosis in Atlantic Sea Scallop (Placopecten magellanicus) Hatcheries

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kyle Brennan

Faculty Mentor: Timothy Bowden

Abstract: The Atlantic sea scallop (Placopecten magellanicus) is one of the most economically important species in the Northeast U.S. and supports the most valuable wild scallop fishery in the world. Aquaculture can supplement domestic supplies of sea scallop meat. Sea scallop farmers need to acquire spat to continue operations, however, wild spat acquisition is unreliable. Hatcheries can potentially produce spat more reliably, but are burdened by mortality events. In Maine, sea scallop hatcheries attribute these mortality events to a bacterial infection; vibriosis. Bacteria such as Vibrio alginolyticus are known scallop pathogens responsible for larval mortality. Probiotics have been shown to decrease larvae mortality when challenged with pathogenic bacteria in other bivalve hatcheries. The use of probiotics on sea scallop larvae is largely understudied. This project will focus on the identification and implementation of probiotics in sea scallop hatcheries to decrease larvae mortality. Research on probiotic candidates effectiveness at countering pathogenic Vibrio spp. in vitro is currently underway. In vivo experiments tracking larvae mortality when treated with promising probiotics and challenged with pathogenic bacteria are to be conducted. Next steps include scaling results to the hatchery and observing interactions between probiotics and larvae. The outcome of this study could influence sea scallop hatchery operations across the state of Maine and support sea scallop aquaculture.

876. Evaluation of Climate Change Through Pollen Record Analysis of Kaskawulsh Glacier Ice Cores

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Margaret Turcotte Seavey

Faculty Mentor: Karl Kreutz

Abstract: Glacial ice cores are collected and used to measure different properties over time. This data can be used to characterize the Earth's climate on time scales ranging from years to millenia. Palynology – the study of pollen – can be applied to ice core research to gain paleoclimatic insights and assess vegetation levels and types at a given time. Analysis of different types of pollen grains and spores also helps in better understanding characteristics of atmospheric circulation and pollen transport. Studies of pollen in snow are useful as well to assess seasonal and interannual climatic variations. This study looks to collect and analyze ice cores and snowpack from Kaskawulsh Glacier, St. Elias Mountains, Yukon, Canada to determine the pollen record and gain a better understanding of historic and current regional climate variability. Results from this study can be used to contextualize previous research at higher latitudes and altitudes in the Arctic region and show how climate change is affecting relatively lower elevations of the Canadian Yukon Territory. The data from cores collected at Icefield Divide will highlight changes to Kaskawulsh Glacier in recent decades and add a snapshot into climatic and atmospheric behavior over recent decades to the record for future study. Analysis of the pollen record at Kaskawulsh Glacier will provide valuable insight into how climate change is affecting the St. Elias Mountains and the greater Kluane Lake National Park region.

877. Sub-daily Variability in Chemistry Sourced from Southwest Greenland Freshwater Streams

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kevin Anderson

Faculty Mentor: Paul Mayewski

Abstract: The Navigating the New Arctic NRT project funded by the NSF focused on understanding the system-level impacts of changing water quality in the Arctic, with a particular focus on southwest Greenland. In June of 2022, we carried out a subset of that study to investigate the variability in chemistry of stream waters over a 24+ hour and a 7 day period at two sites in the Narsarsuaq region. The aim of the study was to understand the impact of meltwater on human and ecosystem health and to establish a baseline for future water quality monitoring in the area. Samples were collected twice daily during a 7-day cycle and every 2 hours during a 24+ hour period from two sampling sites: site 1, a stream in a sheep pasture, and site 2, a stream used for drinking water, both near the town of Qassiarsuk. Chemical analyses focused on major soluble ions (Cl-, Ca2+, K+, Na+, NO3-, Mg2+, SO42-), major elements (Al, S, Ca, Fe, Na, Mg), trace elements (Sr, Cs, Ba, Bi, U, As, Hg, Tl, Li, Ti, V, Cr, Mn, Co, Cu, Zn), and rare earth elements (La, Ce, Pr, Nd, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb, Lu). A total of ~50 samples were collected and analyzed in the Climate Change Institute laboratories. Our results showed that precipitation created a temporary increase in Cl-, Na+, Mg2+, SO42-, and K+ in the stream waters. The average amount of Pb206 for both sites over a 7-day cycle was 60.65 ng/L and for Pb207 58.85 ng/L. During the 24-hour cycle, the average for Pb206 was 59.16 ng/L, and for Pb208 61.26 ng/L. The average amount of Uranium found for both sites over a 7-day cycle was 3117 ng/L, the 24-hour cycle showed an average of 3422 ng/L. Our findings suggest that changes in water quality due to melting glaciers and precipitation events can have significant impacts on human and ecosystem health in the Arctic. According to the World Health Organization (WHO) no amount of lead is safe in drinking water. Additionally, WHO asserts that 15 μg/litre of uranium is permissible for consumption in drinking water, indicating that the level of Uranium detected in the two water sources is within safe limits. The presence of heavy metals such as lead and uranium in the water highlights the need for ongoing water quality monitoring in the region. Our study provides a baseline for future monitoring efforts and underscores the importance of water quality management.

878. Pathogen Prevalence and Correlation to Coliform/E. coli Indicators in Maine Wild Blueberry Operations

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sophia Markus, Robson Machado

Faculty Mentor: Jennifer Perry

Abstract: The pathogen prevalence of wild blueberries isn't understood. An analysis of indicator populations and pathogens in the pre and postharvest environments will help develop effective education and interventions to improve the safety of wild blueberries. In the 2022 harvest season, soil, fruit, surfaces of harvesters, bins and conveyor belts were sampled weekly at five wild blueberry farms. Samples were analyzed by cultural enumeration and were subjected to selective enrichment followed by molecular detection of Salmonella, L. monocytogenes and STEC. Quantitative data were analyzed by ANOVA followed by Tukey's HSD. Correlations between these data and pathogen prevalence were assessed by point biserial correlation. Variability in quantitative data was minimal across site and time, with only yeast levels increasing across the harvest ($p < 0.01$). STEC was the most commonly identified pathogen from the samples, with harvesters testing positive most often. L. monocytogenes was present in soil and fruit samples. No Salmonella was isolated. Presence of STEC was more strongly associated with enumerable coliforms ($p < 0.001$) than generic E. coli ($p=0.036$). Of samples testing positive for STEC, only 62.5% and 37.5% showed the presence of coliform or generic E. coli, respectively. Initial findings suggest that STEC is likely to be the focus of future efforts, but additional data is required. Also, routine surveillance for coliform/E. coli may be insufficient to ensure the safety of the crop.

879. Evaluating cenh3 Loss of Function Mutant Alleles as Efficient Haploid Inducers in Arabidopsis

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Diana Spencer, Margaret Perrotta

Faculty Mentor: Ek Han Tan

Abstract: Efficient haploid induction is highly desirable in plant breeding programs and commercial crop industries. Doubled haploids create pure homozygous plants instantaneously and thereby fixing favorable alleles in a single generation. In Arabidopsis haploid induction through uniparental genome elimination (GE) crosses have efficiencies to induce haploids of up to 45% in Arabidopsis through transgenic GFP-tailswap, a GFP-tagged variant of a centromeric histone H3 (CENH3). However, haploid inducers' efficiency are inversely proportional to their vigor and most efficient haploid inducers are mostly male sterile. Here, we demonstrated that two mutant alleles of cenh3 in Arabidopsis; cenh3-1, a null allele, and cenh3-2, a missense allele, can induce haploids without the introduction of tagged transgene and can be crossed both as either male or female. The most efficient haploid inducer came from homozygote with cenh3-2 when crossed as a male at haploid induction rate (HIR) of 2.58% while the most efficient haploid inducer when crossed as a female came from the line of double mutant cenh3-1/cenh3-2 with HIR of 2.27%. The vigor of our haploid inducers was also maintained, therefore establishing that haploid inducers can be efficient without sacrificing their vigor. As CENH3 can be found across plant systems, the same strategy to employ variant CENH3 without introducing tagged transgene in haploid inducers can be utilized by other plant systems. The ability to induce haploids without introducing transgene to plants is advantageous to crop industries as it eliminates the need to go through regulatory bodies while the vigorous haploid inducers allow for low maintenance of the inducer lines.

880. Development of a Biologically Accurate Artificial Weed for Testing Cultivation Tool Efficacy in a Soil Bin

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Amelia Mooney, Sonora Ortiz

Faculty Mentor: Eric Gallandt

Abstract: Organic farmers face significant limitations with currently available physical weed control (PWC) tools that provide low and highly variable efficacy. To accelerate research and development of advanced PWC tools we are developing a high-throughput testing system using a soil bin system in combination with artificial weeds (AW). We have developed an AW with silicon root structures and plastic leaf shoots that are proportional to, and model, the root behavior (anchorage force) and burial behavior of true weeds in an agricultural environment. Four model AWs were created for this project, with root structures and shoot heights representing early growth stage weeds. AWs were distributed randomly and planted to a uniform depth in a soil bin and then cultivated using a tine rake. We observed the greatest cultivation efficacy in the three-prong AW's (53.3%), and a decreasing efficacy in the 1-prong (35.6%), original Silicon Artificial Weed (SiAW) (24.4%), and 2-prong AW (18.8%). Based on the trends shown in trials of the tine rake on the AW's, they may be a promising candidate for testing burial and uprooting efficacy of weeding tools on farms.

881. Potential Applications Of Modern GPS Technology For Livestock Research

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ashton Caron

Faculty Mentor: Colt Knight

Abstract: Applications of Global Positioning System (GPS) technologies were assessed for their potential application in livestock behavior research. Often, GPS technology commonly used to study livestock behavior are either uneconomical or obsolete. For this project a low-cost gps logger (Mobile Action iGotu GT-600B) was tested for potential applications. Battery life and accuracy of the logger with and without using bluetooth. Loggers were tested by fully charging the logger and setting the logging interval to 2 minutes and keeping it in an open area, without movement until the battery expired and repeated with the bluetooth setting turned on and set to +4 decibels. The results indicate no significant change in battery life or accuracy when comparing the use of bluetooth with no bluetooth. The use of bluetooth would allow researchers to retrieve data without gathering animals and removing the GPS logger, a time and labor intensive process. The logger tracks movement, altitude, location, speed, and can hold ~ 262,000 data points, affording the user to track livestock up to one year recording data at 10 minute intervals with an external battery pack. Location data resolution is < 5 meters. This model has a motion detection feature as well that can allow for extended battery life by only tracking location when movement is sensed. Expected battery life varies depending on how often data is collected, but for research that collects data every 10 minutes, the battery can be expected to last 1440 hours.

882. Co-Occurrence Network Analysis of a Coastal New Jersey Survey using Fishing Trawl and 12s eDNA Data

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Steven Allers, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Recent years have shown a continuous increase in the amount of publications centered around environmental DNA (eDNA) which utilize some form of network analysis -- most commonly, using what are called co-occurrence networks. However, at the same time, there remains a great deal of debate about the usefulness, or the extent of use, that these analyses can reliably provide. Consequently, there is a need for further experimenting and testing with network analysis, in the context of eDNA, to more accurately understand what the best potential uses are. Here we apply the use of network analysis to a co-occurrence network created from a coastal New Jersey survey. Interestingly, this survey contains not only eDNA, but comparative trawl data. We use different forms of network creation, including popular tools such as SparCC (Sparse Correlations for Compositional data), as well as the standard Pearson correlation method. These approaches attempt to find correlations in the way species abundance data changes over time, and draw connections between species when found. Together these connections form a network, which can be subjected to various forms of network analysis. Such analyses have been shown to be powerful and effective tools for many other fields, including those related to internet and social media platforms. Although, comparatively speaking, use with eDNA requires additional steps, there is hope that these forms of analyses may also have the potential to be powerful tools for eDNA surveys which attempt to characterize the complex dynamics of communities in different bodies of water.

883. An Evaluation of the use and Adaptive Sampling Approach to Characterize Microbial Communities

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Claire Nowak

Faculty Mentor: Pauline Kamath

Abstract: Infectious diseases have a global impact, affecting humans, livestock, and wildlife. Pathogen surveillance in wild animals is essential for managing disease transmission and understanding host-pathogen interactions. However, pathogen detection methods often focus on one to a few species, limiting our understanding of multiple co-infecting pathogens' effects on hosts. In this study, we employed a metagenomic sequencing approach to (1) characterize the microbial community in a white-tailed deer (Odocoileus viginianus) that had succumbed to pneumonia, and (2) validate an adaptive sampling sequencing approach that more efficiently targets microbial sequences by excluding the host genome during sequencing. We first performed metagenomic sequencing on DNA extracted from deer lung tissue on a MinION platform (Oxford Nanopore) and then sequenced the same sample using the adaptive sampling approach. The results of the two methods (standard versus adaptive sampling) will be compared in quality control metrics for each run and potential pathogen species identified. We expect that the adaptive sampling approach will have a higher yield of microbial-to-host sequence reads, demonstrating a more efficient targeted method for characterizing microbial communities. In addition, we expect to see differences quality control measures between the sequencing protocols, data which will be beneficial for future work aimed at identifying potential pathogens/parasites linked to pneumonia-related mortality in deer. In sum, this study is expected to validate the use of the adaptive sampling method as a tool for pathogen identification and surveillance, as well as for understanding the role of coinfecting pathogens in complex wildlife disease systems.

884. A Qualitative Analysis of the Collaborative Management Strategy

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Annabel Zlatich, Melissa Flye

Faculty Mentor: Joseph Zydlewski

Abstract: The Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon (Salmo salar) has been federally endangered since 2000. Since listing, the DPS has been jointly managed by a combination of federal (National Oceanic and Atmospheric Administration, United States Fish and Wildlife Service), State (Maine Department of Marine Resources), and Tribal (Penobscot Nation) entities under several governance structures. In an effort to facilitate collaboration among managing entities, the Atlantic Salmon Recovery Framework (ASRF) was formed in 2011. By 2018, the managing entities felt the ASRF was not meeting management needs. Following an evaluation of the ASRF, the Collaborative Management Strategy (CMS) was formed as a pilot program in 2019 to address the structural conflicts identified in the ASRF, 1. slow and ineffective decision making, 2. confusion surrounding leadership and accountability, and 3. low adaptive capacity. In August 2022, we administered a mixed-methods online survey to members of the CMS (n=155; 60% response rate). Using an inductive approach, we used two-cycle coding to identify 4 key themes which were also reflected in participant's quantitative response distributions; 1. ineffective decision-making, 2. confusion surrounding leadership, 3. undefined communication pathways, and 4. confusion surrounding membership. While many of the collaborative concerns identified in the ASRF were still present in the CMS, the new structure is perceived as being more effective and inclusive than the ASRF. Understanding these themes and complex collaborative dynamics will help CMS leadership target participant concerns as the CMS moves from a pilot program to a formal governance structure.

885. The Estimation of Forest Height using Machine Learning

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sylvia Noralez

Faculty Mentor: Daniel J. Hayes

Abstract: Forest canopy have been proposed as an accurate predictor for estimating AGB. Two space-based LiDAR missions, Global Ecosystem Dynamics Investigation (GEDI) and Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2), are gathering forest heights data. This study will examine the possibility of collecting reliable forest heights to facilitate regional forest height mapping of different forest types under different scenarios. The best predictors with enough explanatory power and few independent variables were chosen and tested in different scenarios. Additionally, GEDI's performance in calculating relative height at 95 percentile was also assessed across different forest types. Regression tree approach, Random Forest (RF) and stepwise regression (SR) were used to map canopy height values to Sentinel-1, Sentinel-2, and Landsat remote sensing imagery. A cross-validation approach was performed to validate the performance of SR and RF Models using the coefficient of determination (R2), the root mean square error (RMSE), and the percentage of variance (RMSE%). The results showed that the accuracy of forest heights extracted from GEDI data was higher when using night-time data. Model selection for nighttime frequently favored the combination of spectral indices NDVI84, SAVI and NIR bands and for daytime NDMI, REB6 and TCB. Nevertheless, when compared to the reference map, differences were found to be high within evergreen forests and low in mixed forests. The results have implications for the design of algorithms that combine data from active and passive sensors to map the vertical structure of forests and facilitate the estimation of AGB across different forest types.

886. Seeing the Forests for the Streams: The Framing of Stream Diagnostics for Satershed Management Decision-making

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Cade King, Angeline Casella, Hayden Libby, Morgan Oehler, Samuel Roberts, Bea Van Dam

Faculty Mentors: Sean Smith, Neil Thompson

Abstract: Geomorphologically based diagnostic tools are important to long term watershed management and sustainability solutions in Maine. Fluvial channel conditions and freshwater aquatic habitat are largely governed by water and sediment supplies, resistance to water flow and erosion, and corresponding relations to channel dynamics and morphology. The foundation that watershed diagnostics in Maine woodlands rest upon includes variables predictive of surface runoff, terrain elevations, hydraulic dimensions, and features governing water flows and sediment transport in stream corridors. Changes to water and sediment supply can produce geomorphological alterations with implications to water quality and habitat. Pervasive human activities that have the potential to alter watershed hydrology and erosion patterns in northern Maine woodlands include roadway and skid trail construction, and removal of forest cover on hillslopes and in stream corridors. Contemporary stream systems can be modified by these watershed changes as well as perturbations from past forest harvest operations. They can also be affected by relatively rapid changes in climate that alter the timing and magnitude of stream flows. Here we summarize recent outcomes from efforts to develop stream diagnostic tools tailored to conditions in the headwaters of northern Maine woodlands. The research focuses on Smith Brook watershed down to Fish River Lake in Aroostook County using stream mapping protocols, hydrologic measurements and modeling, and hydraulic analyses. Outcomes are being framed to support watershed management related to large scale forest harvest operations and sustainability of cold water fisheries.

887. The Reproduction and Culture of Aurelia aurita (Moon Jellyfish) in Downeast Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Lindsey Karwacki, Madeline Williams

Faculty Mentor: Brian Beal

Abstract: The common moon jellyfish, *Aurelia aurita*, is a species of cosmopolitan gelatinous holoplankton. This study comprehensively addresses the culture moon of jellies in an aquaculture setting. The long-term goal is to understand moon jellyfish's life history and culture to create displays for public and private aquaria. In May 2020, adult moon jellyfish were collected from Sawyer Park, Brunswick, Maine, and planula larvae were removed from females and grown at the Downeast Institute Beals, Maine over the summer and fall when free-swimming stage individuals were cultured prior to the medusa stage. by November. Moon jellyfish are used in multiple ways: public education, sale for commercial or hobbyist aquaria, and sale for human consumption. Moon jellyfish aquaculture may be one possible solution to diversify coastal economies in Downeast Maine, especially when declining lobster stocks are accompanied by low market prices.

888. Holocene Temperature Variability Based on Alaskan Glaciers

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Katherine Westbrook

Faculty Mentor: Karl Kreutz

Abstract: As global temperatures continue to rise and glaciers melt, the need for understanding long term climate trends is critical. One approach to this problem is to reconstruct past climate variability using terrestrial glaciers. Glaciers are highly sensitive to temperature changes, so retracing previous positions can provide insight into past temperature. In this project, I use wood samples collected from the Mendenhall and Herbert Glaciers, located in Juneau, Alaska. The 39 samples I collected are from in situ stumps and large detrital logs that have recently (within the last ~40 years) melted out of the glaciers. The stumps and logs are from trees that once grew when ice extent was smaller than today. Resurgence of these glaciers subsequently overrode the trees, killing them as they became buried beneath the ice. Recent glacier retreat has exposed these tree stumps. I use radiocarbon dating to find when these trees were over-run by the advancing glaciers. Three periods of advance were found around 2250 BCE, 1000 CE, and 1300 CE. These correspond with known regional advances and further enrich the previously limited data. Additionally, l employed tree-ring analyses and found number of rings in six cookie samples. These ranges indicate duration of ice-free conditions. Modern day retreat appears more extensive than previous periods of recession and indicates that temperatures have changed more than the natural variability of the past 5,000 years.

889. Evaluation of Fungal Community Structure and Recovery Ensuing Experimentally Induced Soil-Nitrogen Perturbation

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Lucia Goldman, Oluwadamilola Kolawole, Evan Warburton

Faculty Mentor: Peter Avis

Abstract: Increased nitrogen availability from sources such as synthetic fertilizer causes shifts in fungal and plant community structures. These shifts ultimately result in a reduction of the total stored soil carbon, buildup of organic matter on the surface, and dissociation between plants and mutually symbiotic fungal species. Experimentation on the effects of soil nitrogen deposition have been conducted at Bear Brook Watershed in Maine, which involved the application of nitrogen fertilizer twice per month from 1989 to 2016 but has since stopped. Using environmental DNA (eDNA) metabarcoding, this study analyzed how the fungal communities have changed over the six years since the last fertilizer treatment to deduce ecosystem and fungal community recovery. Our initial analyses indicate trends toward higher levels of ectomycorrhizal richness in 2022 than in 2016 in the fertilized watershed in contrast to minor shifts observed in our control watershed. These results suggest that at least fungal community diversity responds positively to the decrease in a nitrogen perturbation. Additional analyses on community composition are currently being conducted and will be presented.

Interdisciplinary Research

901. Climate Change, Hydrological Dynamics, and Settlement Patterns in the Supe Valley, 5000 to 3000 cal. BP

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Elizabeth Leclerc

Faculty Mentor: Daniel Sandweiss

Abstract: The Supe valley of Peru is known for an impressive cultural florescence in the Late Preceramic Period (ca. 5000 to 3800 calibrated radiocarbon years before present [cal. BP]), perhaps best recognized at the monumental center of Caral. Working from published data and descriptions, especially those found in general audience publications from the Peruvian Ministry of Culture's Zona Arqueológica Caral, I examine changes in settlement patterns of the Supe Valley from ca. 5000 to 3000 cal. BP and consider how those patterns may have intersected with hydrological changes implied by paleoclimate data and basin-scale paleohydrological modeling. These data and the model suggest that a neoglacial period from ca. 5000 to 4000 cal. BP, followed by a warming trend and continued strengthening of the South American Summer Monsoon ca. 4000 cal. BP, would have affected the seasonality of river flow and groundwater levels in the lower regions of the Supe basin. These environmental changes correlate with contraction and redistribution of settlements around 4000 cal. BP. However, data from the Supe valley also show it remained occupied throughout the 2000-year study period.

902. The Relationship between Diet Quality and Mindfulness in a School of Nursing

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Kayla Parsons, Kelley Strout, Rebecca Schwartz-Mette, Wenjun Zhou

Faculty Mentor: Jade McNamara

Abstract:

Background and Objective
Mindfulness, the act of non-judgemental awareness, has been established as a key influence of health behaviors in various populations. The objective was to explore the relationship between mindfulness and diet quality (DQ) within a school of nursing (SON).

Method
A longitudinal cohort study assessed health behaviors within a nursing program in northeastern public university. Current research evaluated a cross-sectional subsample of responses from an online survey distributed in Fall 2022. Assessment measures included the Five Facet Mindfulness Questionnaire (FFQM) and the Short Healthy Eating Index, which measured mindfulness and DQ, respectively. Pearson's r identified significant associations. Linear regressions analyzed predictors of DQ.

Results:
Participants (N=202, 48.9% completion rate) were mostly female (88%), White (88%) and upperclassmen (72.5%). Responses indicated poor DQ (49.5 ± 13.8) and moderate levels of mindfulness ($3.7 \pm .6$). No correlations existed between DQ and mindfulness scores. Significant associations existed between DQ and acting with awareness, a FFQM subscale ($r=-.14$, $p<0.05$). Acting with awareness significantly predicted DQ ($r2= .02$, $F (1,208) =3.99$, $p<0.05$; ($\beta=-.14$, $p<0.05$). Acting with awareness also significantly predicted added sugar intake ($r2=.02$, $F (1, 208) = 4.24$, $p<0.05$;($\beta=-.14$, $p<0.05$).

Conclusion
Poor DQ and added sugar intake were negatively associated with greater levels of acting with awareness. Results may be explained by a lack of nutrition knowledge when making dietary choices. Further research is necessary in evaluating if mindfulness-based nutrition education interventions improve DQ.

903. A Perspective on the Intersection of Nature and Technology

Submission Type: Exhibit

Submission Category: Interdisciplinary Research

Author(s): Alexander Turanski

Faculty Mentor: Susan Smith

Abstract: The topic I investigate in my work is to discover, visualize and design the intersection between contrasting ideas, material and reality. I have a background of being a balance artist, finding rocks and balancing them in creative ways. Now I'm pursuing a MFA in Intermedia where I am learning to think of the art of balance in a more conceptual and intermedial way, relating the idea of balance to discovering the in between of two opposites. Examples would be hand-made and AI generated art, gravity and floating, the natural elements and plastic. For this project I combined a perspective of nature and technology. Its design comes from qualities of nature and technology to create a visual performance that can only exist through the intersection of both. The rocks are able to balance and be stacked because of gravity. It also falls because of gravity. The ephemeral aspect of a rock stack falling is also a natural quality of life and death. Gravity is one of the most certain realities of natural forces in the universe and rocks are one of the most fundamental forms of natural matter on the planet. To add a perspective only possible with modern technology, I built an inward 360 camera rig with a greenscreen backdrop. I filmed the rock stack falling in slow motion and was able to edit the footage in reverse to create a looped video gif which is artificial in comparison to the natural forward-moving time we experience. This concludes an intersection of nature and technology to create a visual performance only possible through the merge of these two spectrums of reality.

904. Resilience in the Making

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Marina Yacoe

Faculty Mentor: Susan Smith

Abstract: The presence of human resilience is most evident following a challenge to system stabilization. Emotional, physical and spiritual wilderness experiences, expose the presence or lack of resilience through eroded supportive resources. How is resilience fostered to restore doubt to hope; chaos to order; lies to truth; hunger to feast; fear to trust? A resulting Epiphany or Epic Fail expresses the value of the process of explorative risk-taking that is evident in art and science to problem solve; it is the meta-awareness of insight. An interdisciplinary study of resilience that focuses on the the common ground between a theology of suffering and promise, trauma psychology and art making would provide insight for a better understanding of tracking and encouraging wellness where there has been crisis. Problem solving is an intuitive, utilitarian and creative process that requires depth and scope for deployed disaster response teams and rural Maine life-challenges alike. Field study, interviews and documented storytelling through an art-based research framework, will generate insights and data through film and insight analysis. The symbolism of filled and shelved mason jars visualizes my research subcategories: God, grit and dirt. From left to right: the jars full of milk and honey represent the poetic promises of the Old Testament and the grapple with a God who is there or not. Hay and wool place hold the grit of work that is motivated by need and is fueled by problem solving in the hands of human circumstance and ingenuity. The rubber-gloved hand is scientific inquiry; the hand of the farm; the kitchen and the studio. This hand of action or grit is putting -up her stores of glitter as an additional essential element/ingredient of resilience. Glitter makes music, makes love, feasts, warms and worships. It is the dirt to dig into; that which compels and captivates: Truth, beauty and goodness. Resilience in the Making is an integrative, interdisciplinary research project, set in rural Maine, that is also an autoethnographic art-making process. This research project will gather and generate qualitative data that will examine the phenomenology inherent in resilience through generally academically separated (and siloed) approaches to restoration, renaissance and repair.

905. Creating Efficient Anti-Bacterial Surfaces on Catheters with Antibiotic-Free Liquid Coatings

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): ChunKi Fong, Marissa Andersen, Ana Flores-Mireles

Faculty Mentor: Caitlin Howell

Abstract: The use of antibiotics to treat infections is widely recognized as a risky long-term strategy, particularly for widespread complications such as catheter-associated urinary tract infections where the potential for the development of resistance is high. In this work, we use bio-inspired liquid coatings to create catheter surfaces that are protein-resistant and antibacterial without the use of antibiotics and use this as a tool to better understand the relationship between protein adhesion and bacterial adhesion on medically relevant surfaces. Through controlling different parameters in the fabrication of liquid coating, it was possible to control the level of whey protein adhesion to a catheter surface. Protein deposition levels were found to be achievable between 0 and 100% with an accuracy of approximately ±10% compared to uncoated controls. Test on bacterial adhesion mimicked the results of the protein deposition studies, with lower levels of bacterial adhesion on catheters with higher levels of protein resistance. The results demonstrate that liquid coatings can be a useful tool in untangling complex interactions in the colonization of abiotic surfaces by living organisms, and can be applied to the production of antibacterial catheters that do not rely on antibiotics.

906. Deep-Learning Enhanced, Label-Free Detection of Surface Contamination Using a Smartphone and Nanopatterned Material System

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Ainslie Allen

Faculty Mentor: Caitlin Howell

Abstract: Rapid detection of surface contamination is critical to identify potential human health risks before they become larger problems. However, most existing methods to test for contaminants are inaccessible to the general public, particularly in areas with limited resources, such as rural areas, remote field sites, and off-world locations like the International Space Station (ISS). Our research aims to develop an easily accessible smartphone-based surface contamination sensor that can be used to detect a wide variety of surface contaminants in air and water without the need for special resources. Initial work in our labs established that an approach using a low-cost, mass-produced nanopatterned material could be successfully used to differentiate between clean and generically contaminated materials in air, particularly when a targeted machine-learning algorithm was used. Now, we have begun to implement the concept into a smartphone app and apply it to a variety of applications from measuring the cleanliness of a surface to providing information on contaminants in water. The primary components of the app are the smartphone's camera feed, an integrated deep learning algorithm developed using an NVIDIA Jetson Nano Developer Kit, and user feedback. Upon opening the app, the camera feed is used as input for the deep learning algorithm, which recognizes the nanopatterned material and determines where or even what type of contaminant is present. The app then informs the user of the findings and provides next steps. By making this smartphone-based contamination detection app available, we hope to improve the ability of people in remote areas as well as off-world to quickly and easily gain information that can enhance human health and wellness.

907. The Transformation of Performance, Myth, and Poetics Through New Media Technologies Within Intermedia Frameworks

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Sean Lopez

Faculty Mentor: Susan Smith

Abstract: Intermedia is a framework used to describe art activities that fall between disciplines and cannot be defined by one genre but are between genres. Through the utilization of emerging new media technologies within the 21st century, art production has been increasing its development of new genres that defy definition. My research is the production of new genres of performance, mythmaking, and poetry within intermedia arts. Acting through the creative research role of an intermedia arts director and artist, I have been documenting direct observations on new genres of artworks, narratives and histories that are emerging alongside the advent of new media technologies. I implement an interdisciplinary approach that covers multiple disciplines' histories, theories, and praxises of theatre and the performing arts, poetry, new media, philosophy, intermedia, anthropology, and psychology. The goal is to produce scholarship, pedagogy, and creative practice that are unique to 21st century technology. The current field of media technologies that are utilized within intermedia productions are for example but not limited to: video projection mapping, creative coding, motion capturing, generative processing, VR, AR, 3D simulations and modeling. How do these technologies affect performance, storytelling, and poetry? How do traditional performances frame these technologies within new genres? I answer these questions in the utilizing of these technologies in my studio praxis and art production, as well as surveying intermedia history and contemporary practitioners. I am producing essays, interviews with practitioners, and art events that will develop an intermedia framework for performance, myth, and poetry in the 21st century.

908. Exile from the Self

Submission Type: Exhibit

Submission Category: Interdisciplinary Research

Author(s): Aylah Ireland

Faculty Mentor: Susan Smith

Abstract: It is not an uncommon view that emotional/behavioral and mental health issues, much like substance use disorder (SUD) are either willful submissions or cognitive diseases. Using arts-based research, autoethnography, phenomenology, and social psychology, I seek to explore the cultural influences and aspects of identity unification in individuals who experience SUD. I strive to understand the phenomenology of addiction concerning world-making, and how family history, genetics, the environment, and socioeconomic status influence SUD. Most importantly, how can art-making support the full potential of human identity and being in the world?

Human identity is variable from birth through adulthood. This identity exists and is developed in constant interplay with the context with the surrounding world. I consider how, accordingly, succumbing to SUD is a behavioral issue that exists in a constant negative feedback loop with the behavior/emotional and/or mental disorder. If a person has no steadfast solution to this situation, any unified sense of self can divide. As such, I argue that when an individual experiences SUD, an exile from the self comes into being. This exilic form of identity is challenging to address, since similar to the variability of one's own identity, the factors that contribute to maladaptive coping skills, SUD, and whether or not a person seeks treatment and therapy are also variable. Ultimately, an individual must want to change, should they be in the position to do so. I see art as a possible vital resource in creating a pathway for change.

Art practice can be a creative outlet for an individual with SUD as a supplement to self-reflection. During the stages of change, the maintenance phase is long-term and requires practice, much like creative expression. Using creative expression as a supplement to acceptance and as self-reflection, an individual can begin to see—and perhaps change—their way of thinking and being in the world.

909. Establishing Growth Curve Assays for Bacterial Glucosinolate Metabolism

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Marissa Kinney, Ryan Wijayanayake, Johanna Holman

Faculty Mentor: Sue Ishaq

Abstract: Inflammatory bowel diseases (IBD), known to cause dysfunction of the gastrointestinal (GI) tract, have a global impact and often result in disruption to overall health. Diets largely composed of cruciferous vegetables, like broccoli, have been linked to lower levels of inflammation. Glucosinolates, found abundantly in broccoli, are precursor compounds for potential bioactive candidates for inflammation reduction in those with IBD. Recently, research has demonstrated the anti-inflammatory impacts of a broccoli sprout-diet on artificially-induced GI inflammation among pathogen free C57BL/6 mice. Microbiota samples obtained from the digesta, jejunum, cecum, and colon of mice fed broccoli diets curated approximately 806 bacterial isolates. It is expected these isolates will contain more glucosinolate-metabolizing genes. To test this, isolates will be grown up/cultured anaerobically on minimal/selective media containing glucosinolate-related compounds (glucoraphanin, sinigrin). Hydrolysis activity of competent isolates will be determined by optical density. Successful bacterial isolates will be further characterized through LC/MS, confirming the production of bioactive products, and with qPCR via the Bacteroides thetaiotaomicron (B. theta) positive control genome to help identify gene targets (α-1,6-mannanase, glycosyl hydrolase, nicotinamide-dependent oxidoreductase, and transcriptional regulator protein) for glucosinolate conversion in isolates. It is imperative to validate or replicate qPCR protocols which have been established for glucosinolate metabolism in B. theta, in other bacterial species. Additionally, new growth curve assays must be developed for glucosinolate metabolism, as these methods are lacking in published literature.

910. Staging F2M: A Study on Predictors of Which Demographics Identify and Sympathize With Transphobic and Non-Transphobic Characters Through The Play F2M by Patricia Wettig

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Isabella Gellis Morais

Faculty Mentor: Rosalie Purvis

Abstract: This research is a part of my capstone project in Theatre, Psychology, and Women's, Gender, and Sexuality Studies. This project analyzes queer representation both in history and in theatre/media, and also presents a psychological study on the predictors of which demographics are more likely to identify and sympathize with transphobic and non-transphobic characters within a particular play. As a case study, I directed the play F2M by Patricia Wettig (Wettig, 2017), which is a Trans narrative where transphobia occurs in a familial context. Audience members were, then, asked to participate in a survey consisting of several questions about themselves, as well as their reactions to the play. I hypothesized that there would be demographic differences (e.g., age, political orientation, religious affiliation, gender identity) in how participants respond to the play and with which characters they most sympathize. In this presentation, I will review the experience of putting on this performance in the context of representation/activism through theatre and share quantitative data from audience members to understand what predicts sympathetic responses to trans (and trans allied) and transphobic characters.

911. The Veterinary Immersion Plan: An Innovative Solution to Address Non Predictive Barriers to Entering the Field of Veterinary Medicine

Submission Type: Exhibit

Submission Category: Interdisciplinary Research

Author(s): Zachary Inniss, Kurt Jancsy

Faculty Mentor: Sue Ishaq

Abstract: The Veterinary Immersion Plan (VIP), is an innovative online platform designed to eliminate non-predictive barriers and cultivate a harmonious passion for the field of veterinary medicine. Non-predictive barriers, such as socioeconomic, sociocultural, geographic, and accessibility issues, can prevent qualified individuals from pursuing a career in veterinary medicine. The VIP model consists of three stages: Explore, Learn, and Connect. The Explore stage provides information and resources to learn about veterinary medicine career paths and the education and training required to enter these fields. The Learn stage focuses on building an educational foundation in veterinary medicine through simulations, case studies, book clubs, and other resources. Finally, the Connect stage provides online veterinary education opportunities, job and externship opportunities, mental health discussions, and the chance to connect with role models and resources for veterinary experience and passion. This capstone project explores how the VIP aims to address the veterinary workforce crisis by increasing accessibility to veterinary medicine and promoting diversity in the field. Additionally, it aims to decrease burnout and increase mental wellness by cultivating a harmonious passion for veterinary medicine among students. By providing a comprehensive understanding of veterinary medicine and cultivating a harmonious passion for the profession, students are better prepared to enter the profession and overcome non-predictive barriers. VIP is a promising solution that has the potential to lead to social, cultural, and economic impact in the veterinary field by promoting equal opportunity and helping ensure that aspiring veterinarians have the opportunity to succeed, regardless of their background or location.

912. Ode to Nanobubble: A Fusion of Science, Music, and Art

Submission Type: Exhibit

Submission Category: Interdisciplinary Research

Author(s): Ruixin Niu, Benjamin Walker, Kenneth Mensah

Faculty Mentor: Susan Smith

Abstract: "Ode to Nanobubble" is an interdisciplinary project that fuses science, music, and art. It uses Nanobubble technology to create a new music piece, a performance play, and a laser cutting art-piece, demonstrating how the combination of scientific knowledge and artistic elements can lead to a new way of experiencing science.

The music piece is composed based on the idea of the Nanobubble technology, creating captivating themes and melodies. The performance play is divided into two parts: "pollutant" theme played on a 3D printed violin and "Nanobubble" music played on an acoustic violin, with a scientist student taking the narrative role to give the audience a general idea of Nanobubble technology. This performance aims to provide a multi-sensory experience that combines music, storytelling, and science. Moreover, the project includes an art-piece created by laser printing that showcases the music score and the Nanobubble technology that inspired the music piece.

The project highlights the intersection of science, music, and art, demonstrating the power of collaboration and creativity. It provides a unique opportunity to bring scientific knowledge to a wider audience in a way that is accessible and engaging. The project seeks to inspire curiosity and creativity, fostering an appreciation for the beauty and wonder of science, music, and art.

913. Spheres of Influence and the Space Between

Submission Type: Exhibit

Submission Category: Interdisciplinary Research

Author(s): Merrilee Schoen

Faculty Mentor: Susan Smith

Abstract: "Spheres of Influence and the Space Between" is a visual, research based project that uses traditional sculpture to conceptually envision spatial connections, intersections, overlap, and isolation. It is one exposition of a series that vary in form but that all examine social power systems, ephemerality, concepts of proxemics and distances between self and others.

When looking down upon the seemingly static sculpture displayed on the pedestal, one views the circular frames themselves, alternating in size and distance away from the viewer. At this angle, a visitor can also notice faint shadows created by the presence of these spherical forms. Some of the forms are empty, some filled with light paper. As the viewer continues to look at the sculpture from various angles, one notices compass pencils attached to some of the spheres, on swivels. This illustrative puzzle invites mark making from the viewer. The necessity of making a mark in the present is inseparable from the mark maker that came before. A singular sphere is part of a whole. Implications of public and private space designation are present as the participant begins to move the compass, noticing that it also moves spheres within its path to create new lines, shadows and shapes within the space provided. Mark making is an act of power. This piece is informed by social movement language and tactics, historical references to and contemporary understandings of socially engaged art as well as models from participatory design research and the humanities.

914. Statistical Analysis of Attacks Labeled as Terrorism vs Non-Terrorism

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Peter Cusack, Sebastian Chamberlin

Faculty Mentor: Asif Nawaz

Abstract: Purpose: The purpose of this study is to compare public reactions to violent events labeled as terrorism and those that are not. The United States Code lacks explicit criteria for classifying an event as terrorism. Thus, classification decisions are made on a case-by-case basis by law enforcement and government officials based on a variety of factors. However, such classifications, or lack thereof, can have serious consequences for how people react to violent events. The study employs Twitter to sample the public reaction to four major events: the San Bernardino shooting in 2015 and the Pensacola Naval Air Base shooting in 2019, the Parkland School shooting in 2018 and the Pittsburgh Synagogue shooting in 2018.

Design/methodology/approach: Tweets will be collected using the Twarc2 package (Summers et al. 2015) in Python through Academic Research Access via Twitter Application Programming Interface (API) and the sentiment analysis will be done using a mixed-method approach through the programming interfaces Stata and RStudio.

Expected Findings: We expect to find that violent incidents classified as terrorism will have a greater psychological and emotional impact on people than events classified as non-terrorism.

Significance: The study is significant because it will provide insights into how the public perceives and reacts to various types of violence, as well as how the use of the term "terrorism" can shape public opinion and government policy.

915. Landfills, an Overlooked Cost to the PFAS Global Crisis

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Molly Shea, Dianne Kopec

Faculty Mentor: Caroline Noblet

Abstract: PFAS (per- and polyfluoroalkyl substances) are a group of man-made chemicals that are used in consumer and industrial products around the world. These chemicals do not break down over time and have been linked to adverse human health effects. Maine has taken substantial steps to reduce the prevalence of these chemicals in drinking water by banning the use of wastewater residuals (sludge) as a fertilizer for farms. However, these actions have led to changes in how we dispose of PFAS contaminated sludge which presents an array of new challenges. PFAS laden sludge entering landfills has caused strain to landfills in ways that are not well-known, including increased volume of waste, cost of transportation and costs associated with potentially contaminated landfill leachate. The current research investigates these costs in an effort to inform decision-makers about the consequences of changing the way Maine addresses contaminated wastewater disposal. Utilizing Juniper Ridge Landfill data, we explore how Maine's changing sludge policies, LD 1911, have changed the inflow of sludge to the landfill. We use Maine citizen survey results to motivate how this strain on landfills from PFAS is overlooked. We examine the current literature to explore some of the indirect environmental costs to landfills from PFAS including transportation costs, contamination to the environment and indirect costs to landfills that all may be reflected in higher water and sewer bills for Maine citizens. While Maine is taking strides to address PFAS contamination around the state, this work highlights the importance of understanding the indirect costs.

Biomedical Sciences

1001. Investigating the Role of Translation Associated Proteins, IGHMBP2 and NEMF, in Motor Neuron Disease and Development

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sarah Holbrook, Amy Hicks, Jennifer Stauffer, Paige Martin

Faculty Mentor: Greg Cox

Abstract: Deleterious recessive mutations in the helicase immunoglobulin h mu-binding protein 2 (IGHMBP2) gene create a spectrum of motor neuron diseases (MNDs) ranging from the less severe young adult onset motor and sensory neuropathic disease, Charcot-Marie-Tooth disease type 2S (CMT2S), to the severe young childhood disease, Spinal Muscular Atrophy with Respiratory Distress type 1 (SMARD1). We have also conducted studies on MND mouse models with deleterious recessive mutations in the nuclear export mediator factor-encoding gene Nemf. Due to the rarity of these diseases, not much research has been invested into possible therapeutics, let alone the role IGHMBP2 and NEMF play in causing MNDs. IGHMBP2 is believed to have a role in translation because of its association with ribosomes while Nemf is associated with ribosome quality control. Through the creation of several mouse models representing the spectrum of disease found in human patients, we have made strides in understanding that IGHMBP2 and NEMF play a role not only in these diseases, but in neuromuscular development/maintenance. We recently performed RNA sequencing on our severe Ighmbp2 and Nemf mouse models and found that the immune system RIG-I-like receptor (RLR) pathway is highly upregulated in the spinal cords of these mice. This pathway is associated with the detection of viral double-stranded RNA. We bred mice to be heterozygous for mutations in both Nemf and Ighmbp2. While a heterozygous phenotype is not seen for each mutated gene alone, these double heterozygotes showed a severe MND phenotype. This data suggests that these mutations impact the same pathway.

1002. Intravital Imaging of the Host-pathogen Interaction in Larval Zebrafish to Identify C. albicans Immune Evasion Factors

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Bailey Blair, Emma Bragdon

Faculty Mentor: Robert Wheeler

Abstract: In 2020 Candida was the most frequent cause of bloodstream infections in the U.S. The first line of defense against these infections is the innate immune system. Previous work suggests that early immune response is critical in controlling C. albicans infection. However, it has been seen that C. albicans has strategies to evade the host immune system. Evidence suggests that the ability to transition from yeast to hyphal growth may facilitate immune evasion by limiting early phagocyte recruitment and uptake of C. albicans. Reduced containment of C. albicans can lead to uncontrolled hyphal growth, causing damage that can lead to death. However, the mechanism by which C. albicans limits recruitment or containment is unknown. To uncover factors important in innate immune evasion, we utilized the transparent larval zebrafish infection model to screen C. albicans mutants for altered virulence and immune response. Ten of the 130 mutants screened had markedly reduced virulence. Many of these mutants also induced an altered immune response. RIM101 and NMD5 were found to play a role in limiting phagocytosis, while CHT2, CEK1 and RBT1 were found to limit the recruitment of macrophages and or neutrophils to the infection site. These mutants will be useful in identifying fungal pathways that down regulate the different steps of the innate immune response during infection. These results highlight the ability of C. albicans to use multiple strategies that allow it to impair the immune response.

1003. Winterberry (Ilex verticillata) Leaf Extract is Protective Against Manganese-Induced Toxicity in Caenorhabditis elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Aaron Rusiecki, Cara McKinnon, Leah Mastrianno, Michael Croft, Brendan Moline, Zoe Stankevitz, Adrian Webber, Jacqueline Cook, Samuel W. Caito

Faculty Mentor: Jennifer Newell

Abstract: Indigenous tribes in the Northeastern United States have ethically harvested and used the leaves of winterberry, or Ilex verticillata, as teas in tribal medicine. Winterberry belongs to the plant genus Ilex which includes other species that have antioxidant polyphenols in their leaves. These secondary metabolites in plants are a defensive strategy for plants and might act as antioxidants in a variety of chronic diseases including cancer, aging, and neurodegenerative diseases. Manganese (Mn) is a trace mineral and a known oxidant that has been implicated in neurodevelopmental delays, cognitive impairments, Parkinsons' disease, and Alzheimer's disease. Our hypothesis is that winterberry leaf extract (WLE) may act as an antioxidant against manganese-induced oxidative stress. Caenorhabditis elegans were pre-treated with increasing concentrations of WLE in a dose-response survival curve and the LD 50 was calculated to be 5.87%. Total reactive oxygen species (ROS) was measured in the presence of WLE and manganese (II) chloride and a two-fold dose dependent decrease in the total ROS was observed. Using a fluorescent reporter strain, antioxidant response activity was significantly decreased in WLE-treated worms following Mn treatment. Similarly, WLE alone increased glutathione levels and prevented loss of glutathione in Mn-treated worms. As oxidative stress is implicated in aging, a lifespan assay was performed to evaluate the impact of WLE on C. elegans survival over time. Kaplan-Meier analysis suggests a protective one-day mean survival time of WLE in response to Mn. These results suggest that compounds in WLE are protective against the oxidative effects of Mn in vivo.

1004. JC Polyomavirus Infection is Reduced by Disruption of Host-Cell Calcium Signaling Pathways

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Avery Bond, Mason Crocker, Michael Wilczek, Amanda Sandberg, Lucas Bennett, Nicholas Leclerc

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) is a ubiquitous virus which infects 50-80% of the human population. In healthy individuals, JCPyV causes a persistent, asymptomatic infection in the kidneys that lasts a lifetime. In severely immunocompromised individuals, such as those with HIV/AIDS, JCPyV can cause a fatal brain infection called progressive multifocal leukoencephalopathy (PML). PML causes a lytic infection of myelin-producing glial cells and becomes progressively debilitating, often resulting in death within one year of symptom onset. Unfortunately, there are currently no targeted, approved treatments for PML, underscoring the importance of continued research on JCPyV and PML. In an effort to identify antiviral therapeutics, the Maginnis laboratory performed a large-scale drug screen using the National Institutes of Health Clinical Collection (NIH-CC), which contains FDA-approved drugs and therapeutics in various stages of clinical trials. Over 700 drugs were screened using a high-throughput In-Cell Western assay for their capacity to reduce JCPyV infection. Results demonstrated that multiple FDA-approved drugs from several drug classes reduce JCPyV infection. Multiple “hits” identified were drugs that target cellular calcium signaling pathways. Calcium channel blockers and related calmodulin inhibitors have been further characterized by viral infectivity assays with results supporting a role for calcium signaling during JCPyV infection. Additional detailed characterization of drugs that block JCPyV infection may result in identification of antivirals for JCPyV infection and PML. Exploring pre-approved drugs from the NIH-CC is a promising and demonstrated method for repurposing therapeutics and is an efficient method for uncovering potential treatments for PML.

1005. Antioxidant Effects of Partridgeberry Leaf Extract

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Jacquelyn Cook, Samuel Caito

Faculty Mentor: Jennifer Newell-Caito

Abstract: Mitchella repens, or partridgeberry, is a plant that is native to eastern North America and has an extensive history within the medicinal practices of Indigenous tribes. Historical records indicate Indigenous Americans treated childbirth pains, rheumatism, and back pain with tea created from their leaves. Previous research has indicated that the berries of partridgeberry are rich in polyphenols, however research regarding their leaves is minimal. Polyphenols are plant compounds that are known antioxidants. Antioxidants provide an extensive range of health benefits as they balance free radicals created from oxidative stress. Too much oxidative stress induced from the heavy metal manganese (Mn) plays a critical role in the development of age-related neurodegenerative diseases. Three separate extracts were created from partridgeberry leaves (PLE) collected from the Bangor City Forest. The total phenolic content of the PLE was determined to be 1170 +/- 70 mg. Nematode worms, Caenorhabditis elegans, were chosen as the model organism in these experiments due to short life span, genetic mutability, and prior studies indicating oxidative stress due to Mn exposure. A dose-response survival curve was created from worms pre-treated with increasing concentrations of PLE and the resultant LD50 was calculated to be 26.05%. Since Mn-exposed worms have shorter survival, a lifespan assay was performed to evaluate the effect of PLE pre-treatment in these worms. This is the first study to show polyphenolic compounds in PLE act in vivo as antioxidants in Mn-treated worms.

1006. Using Intravital Imaging in Zebrafish to Understand Signaling Underlying Neutrophil-mediated Immunity to C. albicans Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Nnamdi Baker

Faculty Mentor: Robert Wheeler

Abstract: Candida albicans is a commensal fungus affecting immunocompromised patients due to their impaired innate immune response which is integral in preventing lethal invasive candidiasis. Neutrophils maintain immunity by being recruited to the site of infection and clearing it through phagocytosis or production of extracellular traps. However, defects in recruitment lead to human disorders like WAS (Wiskott-Aldrich Syndrome), LAD (Leukocyte Adhesion Deficiency) or WHIM (Warts, Hypogammaglobulinemia, Infections, and Myelokathexis) which all promote increased susceptibility to recurrent infection. Although we understand the molecular defects of each disease, it is unclear how those defects translate to altered phagocyte recruitment, phagocytosis, and fungal killing. Intravital imaging of mutant neutrophils in the context of infection could shed some light into how each defect affects distinct aspects of the neutrophil's functional response. To quantify defects in neutrophil recruitment and clearance, we have monitored neutrophil recruitment in larval zebrafish during hindbrain injection of C. albicans. This route of infection models a systemic infection. Our preliminary results modeling loss of gradient sensing indicate that the CXCR2 receptor is important for immunity in this infection route, as expected. However, blockade of this receptor does not significantly diminish neutrophil recruitment to the infection site, suggesting that other functions of CXCR2 signaling are important for controlling candidemia. Future work will continue to examine these neutrophil immune pathways in control of wildtype as well as evasion-deficient strains of C. albicans. A cellular understanding of the roles of these pathways in candidiasis may lead to targeted treatments for increasing survival in immunosuppressed patients.

1007. Refine Nerve Conduction Study Method in Sciatic Nerve Crush Model of Neuropathic Pain

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Felix Anim

Faculty Mentor: Ling Cao

Abstract: CD137L is a co-stimulatory molecule whose signaling contributes to chronic pain development potentially by promoting pro-inflammatory response-mediated sensitization. Our previous data showed that CD137L knockout (KO) mice displayed reduced sensory hypersensitivity following sciatic nerve crush (SNC). We plan to evaluate the effects of CD137L on the electrophysiological nature of the sciatic nerve through nerve conduction studies (NCS) of the sciatic nerve using anesthetized animals in a minimally invasive manner. In a typical setting for NCS, the stimulation occurs at sciatic nerve notch area and recording at the hind paw. Regarding the stimulation, previously, we have used a pair of electrodes (10 mm, anode and cathode). However, we experienced significant inter-experimenter variability and occasional difficulty in keeping the electrodes parallel to each other. Here, we evaluated the use of a concentric needle (25 mm) as it combines anode and cathode electrodes into one and may be less experimenter dependent. Four male CD137L KO mice (2 SNC and 2 sham) were tested from days 0 to 77 and additional neuropathic pain-related behaviors were evaluated simultaneously. Comparing to our previous results, the recorded maximum amplitude and latency showed similar trends respectively, however the recovery appeared to start later. The duration of the maximum amplitude had larger variability and did not show a clear pattern following the surgery. This is likely due to the small sample size and the relatively longer length of the concentric needle. Thus, further refinement of the recording technique is required for more consistent and precise NCS data collection.

1008. PLK-3 Localizes to the Transition Zone in Caenorhabditis elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Courtney Willey

Faculty Mentor: Dustin Updike

Abstract: Polo-like kinase 3 (PLK-3) is a commonly overlooked protein that has been found to co-immunoprecipitate (co-IP) with (LOTR-1) only in young adult Caenorhabditis elegans (C. elegans). LOTR-1 is a LOTUS and Tudor domain containing protein that docks next to P-granules to co-localize with the Z-granule helicase (ZNFX-1) to balance epigenetic signals in the germline. However, when LOTR-1 carries a deletion in the LOTUS domain or the Tudor domain, PLK-3 no longer coIPs with LOTR-1, suggesting PLK-3 has a critical role in the germline. To investigate the role of PLK-3 and its involvement with LOTR-1, a PLK-3 transgenic worm was created to visualize PLK-3 location using green fluorescent protein (GFP). Microscopy of these transgenic worms revealed the PLK-3 protein localized to the transition zone in C. elegans and appears to co-localize with P-granules. Early meiotic prophase occurs within the transition zone, and in C. elegans, cis-acting sequences near one end of each chromosome assemble a nucleoprotein complex that tethers the chromosome ends to the nuclear envelope. The nucleoprotein complexes act as recruitment sites for polo kinase, PLK-2 (or PLK-1, if PLK-2 is absent), since PLK-2 and PLK-1 are capable of inducing structural reorganization of the nuclear envelope, perhaps PLK-3 may also be involved. The generation of a PLK-3 knockout mutant could allow us to further characterize PLK-3, its involvement with LOTR-1, and reveal more about its role in the germline

1009. Serological Levels of IL-34 in Transgenic Mice

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Hannah Megathlin

Faculty Mentor: Lenny Shultz

Abstract: IL-34 is a cytokine expressed by neurons and keratinocytes. It signals mainly through CSF-1R and has been shown to be necessary for the maintenance of microglia in adult mice. There is evidence that administration of IL-34 can improve cognitive function in neurodegenerative diseases. IL-34 has also been shown to play role in inflammatory diseases in areas other than the brain. Reported serological levels of IL-34 in humans varies greatly in both healthy and diseased states, with higher levels reported in disease states. To research the role of human IL-34 in disease, two transgenic mouse models expressing human IL-34 were created, a randomly integrated transgenic model and a knock-in model. To determine how the levels of human IL-34 compared in these models with the reported levels in humans, blood was collected from both models at various ages and sexes and the levels of both mouse and human IL-34 were measured using ELISA. There was no mouse IL-34 detected in any of the samples tested as the levels were below the ELISA kit detection limits. In line with the results reported in human studies, there was a great amount of variance in the levels of human IL-34 measured. The maximum measured levels of human IL-34 in the mouse models were significantly higher than those found in humans, with age and sex significantly affecting the measured levels. However, in many of the samples no human IL-34 was detectable. In the future, the IL34 measurements should be repeated with a more sensitive assay to try and quantitate minimal levels of IL-34.

1010. Examining the Effects of Loss of Sipa1l2 on CMT1A Phenotypes Using Mouse Models

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): George Murray, Timothy J. Hines, Abigail L.D. Tadenev

Faculty Mentor: Robert Burgess

Abstract: In 2019, a patient-only GWAS of Charcot-Marie-Tooth type 1A (CMT1A) patients found an association between variants in signal induced proliferation associated 1 like 2 (SIPA1L2) and the strength of foot dorsiflexion, which is variably diminished in patients. Sipa1l2 knockdown experiments in rat schwannoma cells demonstrated that decreasing Sipa1l2 transcript caused a corresponding decrease in peripheral myelin protein 22 (Pmp22) transcript abundance. Because PMP22 overexpression causes CMT1A in patients, SIPA1L2 became an interesting potential therapeutic target for CMT1A, but in vivo tests were needed to validate the disease modifying effect. We deleted 1,877 bp including the first exon of Sipa1l2 using CRISPR in C57BL/6J mice and then crossed the C3-PMP22 mouse model of CMT1A into the Sipa1l2 -/- background. We performed neuromuscular phenotyping, nerve conduction velocity (NCV) recordings, histopathology, and gene expression analysis with mice from this cross. CMT1A-associated deficits in NCV were not improved by Sipa1l2 knockout, but we did observe an improvement in muscle endurance and increased myelin thickness in femoral nerve motor branches with fewer totally demyelinated axons. Gene expression analysis implicates pathways such as cholesterol biosynthesis in CMT1A pathophysiology and shows that Sipa1l2 knockout also produces a gene expression signature associated with cholesterol biosynthesis. Interestingly, the knockout seems to normalize CMT1A-associated gene expression signatures for all but the most strongly enriched pathways. These results suggest that targeting Sipa1l2 in the C3-PMP22 mouse model does modify several neuromuscular disease phenotypes but does not completely restore wild type performance.

1011. Neuromuscular Characterization and Development in DPM3-associated Dystroglycanopathies

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Amanda Ignacz, Claire Schaffer

Faculty Mentor: Clarissa Henry

Abstract: Glycosylation of dystroglycan is essential for skeletal muscle fiber adhesion to occur, and mutations to proteins in the glycosylation pathway can lead to an array of diseases called dystroglycanopathies. Clinical phenotypic variation in individuals with dystroglycanopathies can range from mild with progressive muscle weakness to severe with central nervous system defects, creating difficulty for predicting disease progression and clinical diagnosis. It is essential to understand the mechanisms underlying these diseases to generate therapeutic treatments for dystroglycanopathies, since these diseases currently have no cure. We have recently developed a zebrafish model to characterize disease pathology of one such disease, dolichyl-phosphate mannosyltransferase subunit 3 (DPM3)-associated secondary dystroglycanopathy. To gain an understanding of the DPM3 mutant phenotype, muscle function studies, muscle structure birefringence imaging, and fluorescent immunohistochemistry stains were done at embryonic timepoints from 2 to 8 days post-fertilization. While we did not observe significant changes in muscle structure or function in DPM3 mutants at embryonic stages, we did observe notable myotendinous junction defects and dystrophic muscle structure in heterozygous embryos. Additionally, despite the phenotype being less severe in embryonic stages, DPM3 mutants do not survive beyond juvenile stages of development while heterozygotes do despite having a more severe phenotype earlier in development. Future work with this model will seek to elucidate the mechanisms through which DPM3 impacts disease progression, and ultimately provide potential therapeutic approaches to treating dystroglycanopathy patients.

1012. Karyotyping 4 Strains of Wild-derived Inbred Mice

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Hilda Opoku Frempong

Faculty Mentor: Beth Dumont

Abstract: Inbred mouse strains have been used for nearly a century to empower mechanistic investigations into gene and pathway function. However, the reliance on inbred strains with a static genetic background has limited the translatability of research findings from mouse to human, and underscoring the need for next generation mouse models that more accurately capture human genetic complexity.

Wild mice harbor much greater genomic diversity than their laboratory counterparts and present an opportunity to bring genomic complexity into the fold of biomedical research. To this end, we have been pursuing a course of phenotypic and genomic investigations on a panel of wild-derived inbred strains developed from wild-caught house mice. Our ultimate goal is to develop a novel high diversity outbred mouse population from a subset of strains in this panel. As an initial step toward this mission, we sought to karyotype 4 strains - GAIC/NachJ, MANB/NachJ, EDMB/NachJ, and SARA/NachJ – to assure the absence of large-scale structural rearrangements that could lead to breeding challenges and infertility. To this end, I generated metaphase cell spreads from tail-tip fibroblasts and visualized DAPI-stained chromosomes using high-resolution fluorescent microscopy. I showed that GAIC/NachJ and MANB/NachJ exhibited karyotypes with the expected 40 acrocentric chromosomes. However, EDMB/NachJ, SARA/NachJ had chromosome counts greater than 40. This unexpected finding could be due to karyotypic divergence between strains, but may also be an artifact of prolonged culturing or our protocol for preparing metaphase cells. Further experiments are needed to confirm the karyotype of EDMB/NachJ and SARA/NachJ.

1013. Characterizing Muscle Development in b4gat1-Associated Dystroglycanopathy

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Mia Corradi

Faculty Mentor: Clarissa Henry

Abstract: Neuromuscular diseases such as muscular dystrophy are detrimental to human health and under-researched despite easily accessible model organisms. A rare form of muscular dystrophy is dystroglycanopathy (DGP) which can be caused by mutations in any of the 19 genes. Affected patients may experience muscle damage and eye-brain abnormalities. One gene that can result in DGP when mutated, B4GAT1, is necessary for muscle development and structure. B4GAT1 is involved in sugar synthesis and is found in the dystrophin glycoprotein complex which helps facilitate different functions found in muscle. To study neuromuscular diseases the Henry Lab has developed a novel zebrafish model that harbors a mutation in b4gat1 which exhibits non-functional protein and pathological muscle phenotypes, similar to what has been seen in patients. While it is known that a defect in B4GAT1 can cause muscular defects, zebrafish are one of a few models that accurately reflect what patients experience. Based on current understanding it is hypothesized that B4GAT1 is necessary for the orchestration of muscle development and structure. Continuous research can eventually lead to rescuing the abnormal phenotypes B4GAT1 mutations are associated with and expand the knowledge of neuromuscular diseases in general. Ultimately, researching the impact b4gat1 has on the development of muscle and characterizing the defects observed in dystroglycanopathy can benefit those affected by life-threatening neuromuscular diseases.

1014. BMP9/ALK1 Signaling is Required for Pro-Angiogenic Secretome in Human Cardiac Progenitor Cells

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Michayla Moore, Calvin Vary, Doug Sawyer, Sergey Ryzhov

Faculty Mentor: Calvin Vary

Abstract: Myocardial infarction (MI) is the number one cause of cardiovascular disease mortality. Recent evidence has highlighted the protective role of transplanted cardiac progenitor cells (CPCs) in the regulation of cardiac repair, with an emerging role of CPC paracrine response and secreted proteins in this process. However, the molecular mechanisms for CPC paracrine effects on cardiac tissue function are poorly understood. Our lab has recently isolated a new class of CPCs from the human epicardium (hHiPCs). hHiPC clonal isolates are characterized by their high proliferation rate, CD90, and CD105 (Endoglin) expression. We found that Activin receptor-like kinase 1 (ALK1) is expressed in hHiPC. Using SWATH LC-MS/MS analysis of conditioned media (CM) we have found that pre-treatment of hHiPC with the ALK1 ligand, Bone morphogenic protein-9 (BMP9), increases hHiPC secretion of pro-angiogenic and BMP-regulated secreted proteins, including Sclerostin (SOST), Meflin (ISLR), and CD105, in vitro. Further, transcription of SOST and CD105 was also increased as analyzed by RT-qPCR. To investigate this pathway's role in angiogenesis we found increased tube formation of endothelial cells and hHiPCs in the Matrigel tube formation assay in BMP9-treated CM compared to vehicle control. To further evaluate the role of ALK1 in hHiPC we used a lentiviral vector to reduce ALK1 expression and found significantly decreased RNA expression of pro-angiogenic factors CD105 and SOST following BMP9 treatment. These findings implicate BMP9/ALK1 signaling in cardiac progenitor cell secretome-mediated repair, and support further investigation using in vivo models.

1015. Microglia Depletion Increases Susceptibility for Glaucomatous Neurodegeneration in Ocular Hypertensive Mice

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Cory Diemler

Faculty Mentor: Gareth Howell

Abstract:
PURPOSE
Microglia responses occur early in the pathogenesis of glaucoma and other neurodegenerative diseases. In recent years, changes in microglial states have been correlated with later glaucoma severity; however, their specific role(s) are not known. We hypothesize that the depletion of microglia with a dietary CSF1R inhibitor would alter glaucomatous optic nerve damage in an aged ocular hypertensive model.

METHODS
Dietary PLX5622, a CSF1R inhibitor known to decrease populations of microglia in the retina, was introduced to 9.5mo-old DBA/2J mice (a widely used model relevant to ocular hypertension). Microglial depletion was confirmed with retinal tissue RNA-seq analysis (n=4 per diet per sex). Intraocular pressures (IOPs) were measured, and retinal ganglion cell (RGC) function was assessed by measuring pattern electroretinography (PERG) amplitudes and latency at 9, 10.5, and 12mo of age. (n=10 per diet per sex). At 12mo, optic nerves were evaluated for glaucomatous damage using p-phenylenediamine staining (n=12 per diet per sex). Retinas corresponding to the assessed optic nerves were isolated for confocal microscopy (n=6 per diet).

RESULTS
Pilot studies showed that 75% of retinal microglia are depleted after 3wks exposure to PLX5622. Microglia depletion was further validated by RNA-seq analysis that showed significant downregulation of microglia-specific genes including Tmem119, and P2ry12. 10wks exposure to PLX5622 revealed no significant differences in PERG amplitude and latency, IOP, or RGC soma number between dietary groups. However, analysis of optic nerves showed a significant PLX5622 diet-associated increase in moderate-to-severe optic nerve damage ($p= 0.0022$).

CONCLUSION
Our results indicate that reducing the retinal microglial population from 9.5 to 12mo increased

susceptibility for glaucomatous neurodegeneration in DBA/2J mice. This suggests a potential beneficial effect of microglia in glaucoma. Experiments are underway to determine whether this overall beneficial effect can be boosted by renewing the microglia pool just prior to IOP onset and optic nerve damage through short term exposure to PLX5622. Future studies will include targeting specific states of microglia through disruption of genes known to control activation including the triggering receptor expressed on myeloid cells (TREM) gene family.

1016. Investigating the Role of b4gat1 as a Facilitator of Axon Guidance and Muscle Development

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Kodey Silknitter, McHenna Martin, Mia Corradi, Benjamin King

Faculty Mentor: Clarissa Henry

Abstract: The dystroglycan complex is a glycosylated, transmembrane receptor that binds to extracellular proteins and is critical for muscle development. Dystroglycanopathy is a subset of muscular dystrophies in which one of the 19 proteins responsible for alpha-dystroglycan glycosylation is non-functional. A rare form of dystroglycanopathy arising from mutations in B4GAT1, an alpha-dystroglycan glycosylation gene, was first identified in 2013. Clinical presentation includes brain abnormalities, congenital muscular dystrophy, and shortened lifespan. Previous studies have found that when b4gat1 is knocked-out in zebrafish, there is little to no glycosylation of alpha-dystroglycan. Additionally, when B4gat1 is truncated in mice, they display muscular dystrophy and disrupted axon guidance. Although there is a clear relationship between B4GAT1 and development of the neuromuscular system, the disruption of axon guidance on muscle health in this context has not been investigated. Preliminary data suggests that primary motor neuron axon guidance and subsequent muscle development are variably disrupted in multiple forms of dystroglycanopathy. Our current hypothesis is that b4gat1 is required for proper muscle development via aiding in motor neuron axon guidance. We have generated novel dystroglycanopathy zebrafish models including zebrafish harboring a mutation in b4gat1. These mutants display muscle fiber disruption by 5 days post fertilization. We are characterizing these mutants via immunohistochemistry staining and live time-lapse microscopy and expect to find that development of the motor neurons has a direct impact on muscle health. Ultimately, these findings will offer a clearer understanding of how b4gat1's role as a necessary component of axon guidance is responsible for muscle development.

1017. Autophagy Controls GPCR Abundance at the Plasma Membrane

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Nicholas Leclerc

Faculty Mentor: Joshua Kelley

Abstract: G protein-coupled receptors (GPCRS) are a central junction between extracellular cues and intracellular signaling, playing key roles in various sensory processes such as intercellular communication, chemotaxis, and nutrient sensing. Ste2 is a GPCR in yeast which directs changes in gene expression and cell morphology through Gα and Gβγ signaling upon pheromone detection. This downstream signaling also upregulates autophagy, but the reason for this is not understood. Autophagy is a biological process which promotes cell survival in response to nutrient deprivation and other stressors. This is achieved through the engulfment, degradation, and recycling of cytosolic regions. In a nutrient-deprived environment, we have observed a disappearance of Ste2 from the plasma membrane. Further, Ste2 reappears at the plasma membrane when nutrient-deprived yeast in the stationary growth phase are reintroduced to the nutrient-rich log phase. This nutrient dependence of peripheral GPCR abundance suggests the induction of autophagy may promote receptor internalization. To test this, we directly inhibited Tor with rapamycin to mimic nutrient deprivation under vegetative conditions, which caused a greater decrease in receptor abundance at the plasma membrane. To determine the specificity of this response, we tested the effect of rapamycin on Ste3, the pheromone GPCR of the opposite mating type. We found that rapamycin causes a decrease of Ste3 at the periphery. Both GPCRs required for mating in yeast are downregulated in response to starvation, suggesting autophagy may serve as a mechanism to delay or prevent mating during times of nutrient deprivation.

1018. The Role of Calmodulin-Dependent Protein Kinase IV in Regulating JC Polyomavirus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Aiden Pike, Michael Wilczek, Melissa Maginnis

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) causes a persistent, asymptomatic kidney infection in a majority of the population. In immunocompromised individuals, JCPyV can spread to the brain and cause the fatal demyelinating disease, progressive multifocal leukoencephalopathy (PML) characterized by glial cell death. There is currently no treatment for PML, and the mechanisms of JCPyV infection remain poorly understood. Defining the signaling pathways implicated in infection could help identify novel treatment targets. Preliminary evidence from the Maginnis laboratory implicates calcium signaling in JCPyV infection, and altering these pathways reduces infection. Calcium signaling stimulates calmodulin-dependent protein kinase activity, resulting in transcription factor activation for gene expression. Calmodulin-dependent protein kinase IV (CaMKIV) is known to stimulate NF-κB, a transcription factor responsible for activating multiple cellular responses. Bioinformatic analyses have revealed that NF-κB binding site frequencies in the JCPyV genome are altered in viral isolates from various PML patient tissues. Additionally, CaMKIV is differentially expressed in laboratory cell models throughout the course of JCPyV infection. The goal of this project is to analyze the role of NF-κB activity and CaMKIV in JCPyV infection. To determine the impact of NF-κB activity on JCPyV infection, cells were treated with varying concentrations of glucose, a known stimulator of NF-κB, and infection was measured. The role of CaMKIV in JCPyV infection was determined by treating cells with inhibitors to reduce CaMKIV activity, and viral infectivity was quantified. Taken together, this research improves our understanding of NF-κB and CaMKIV in viral transcription and JCPyV infection, helping to illuminate potential treatment targets.

1019. Effect Low-dose Arsenic Exposure on the Expression of Interferon Response Genes During the Innate Immune Response to Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Julianna Grampone, Haley Foreman, Brandy Lee-Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: An estimated 650,000 deaths occur yearly from respiratory diseases associated with seasonal influenza virus infections. Influenza A Virus (IAV) is one of four types of influenza viruses where changes in the viral genome through antigenic drift and shift pose a significant threat to global health. The WHO set the standard for arsenic concentration in safe drinking water to be less than 10 parts per billion (ppb). Arsenic exposure through drinking contaminated water is a public health concern that affects 2.1 million people in the US and more than 300 million worldwide. Arsenic exposure is associated with increased death and morbidity from viral infection, and we hypothesize that arsenic dysregulates the inflammatory response to IAV infection through the interferon signaling pathway. We aim to determine whether low-dose arsenic exposure alters interferon signaling using a larval zebrafish model of IAV infection. Our preliminary studies show that 10 ppb arsenic decreases survival while upregulating immune-related gene expression. Additional experiments have demonstrated an increase in innate immune cells responding to infection. Based on these results, we hypothesize that environmental arsenic increases the severity of viral disease by inhibiting down-regulation of numerous genes that orchestrate the inflammatory response to viral infection, leading to excessive inflammation. Our studies advance our basic understanding of the innate immune response to IAV and how arsenic dysregulates the inflammatory response to IAV infection by activating the interferon response signaling pathway.

1020. Long-chain Acyl-CoA Synthases Support Multiple Myeloma Proliferation and Mitochondrial Function

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Connor Murphy, Victoria DeMambro, Samaa Fadel, Carlos Gartner, Yulica Santos Ortega, Calvin Vary

Faculty Mentor: Michaela Reagan

Abstract: Multiple myeloma (MM) is the clonal expansion of malignant plasma cells in the bone marrow and has a 5-year survival rate of 57.9%. Obesity correlates with increased incidence of MM and a poor treatment response in MM patients. However, the mechanism of how dysfunctional fatty acid (FA) metabolism contributes to MM is unknown. There is a critical need to understand how FA metabolism contributes to support MM. FA metabolism alterations in other blood cancers and solid tumors have been shown to support cell proliferation. Thus, we hypothesized that FA metabolism is important to supporting MM proliferation or survival. MM-supportive FA metabolism genes were identified in the Hallmark FA Metabolism gene set within the Cancer Dependency Map, a genome-wide CRISPR screen of human cell lines. We found that the long-chain acyl-CoA synthetase (ACSL) family members, which activate FAs so they can be metabolized, supported MM cell line fitness. We therefore hypothesized that the ACSL family supports MM cell survival or proliferation.

To test this hypothesis, we treated 5 distinct human MM cell lines with an inhibitor (Triacsin C, TriC) of four of the five human ACSLs. TriC decreased MM cell proliferation mitochondrial number and membrane potential and increased apoptosis. MM.1S cells treated with TriC for 24 hours had significantly decreased basal, maximal and ATP-dependent respiration and mitochondrial ATP production rate.

Taken together, our data suggest that ACSLs support MM cell proliferation, survival and mitochondrial function. Future studies will investigate the mechanism of ACSL-dependent inhibition of mitochondrial function.

1021. The Zebrafish mylpfa Mutant Suggests That Muscle-specific Disparities in Gene Compensation May Explain the Defining Symptoms of Distal Arthrogryposis

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sadie Waterman, Tayo Adekeye, Emily Tomak, Josh Kelley

Faculty Mentor: Jared Talbot

Abstract: Distal Arthrogryposis (DA) is a congenital disease characterized by muscle and joint contractures present throughout the body, most severely in the hands and feet. The genes known to cause DA are expressed throughout the musculature and it remains unclear why distal limbs are disproportionately affected. Recent work suggests that missense alleles in the gene MYLPF can cause DA. MYLPF encodes a myosin light chain protein present in all fast-twitch skeletal muscle, which stabilizes the myosin heavy chain near its force-generating head. In this study, we investigated the zebrafish mylpfa mutant, an established DA model; we show that this mutant has muscle defects that are less severe in the flank muscle than they are in the pectoral fin muscle, which is homologous to the human forelimb. We developed a Mylpf-specific antibody for use in Western blot and whole-mount immunolabel. The Western blots revealed a 50% loss of Mylpf protein in the mylpfa mutant compared to the wild-type. Whole-mount immunohistochemistry revealed that Mylpf is expressed brightly in both pectoral fin and flank muscle in the wild-type; however, the mylpfa mutant shows loss of Mylpf label only in the pectoral fin. We propose that the mylpfa mutant flank muscle retains Mylpf label because of compensation by functional orthologs, such as Mylpfb, but this compensation fails in the pectoral fin. Likewise, human DA may disproportionately affect the limb because of a similar deficit in gene compensation.

1022. Quantifying Birefringence Images of Zebrafish Using a Mix of Deep Neural Networks and Image Analysis Tools

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ahmed Almaghasilah

Faculty Mentor: Clarissa Henry

Abstract: In Henry's lab at University of Maine, we study muscular dystrophies such as Duchenne Muscular Dystrophy, a genetic disorder that results in progressive weakening and loss of muscle fibers and can lead to early death in children. We use birefringence, a non-invasive, live-imaging technique that uses polarized light to visualize muscle fibers of zebrafish. This technique allows us to assess the effectiveness of several therapies, which attempt to improve the functionality and structure of muscle fibers, applied on zebrafish with muscular dystrophies. The birefringence images are quantified by highlighting the zebrafish first and then calculating the mean gray value. However, the experiments typically generate a huge volume of images and quantifying these images manually can be an extremely time-consuming process. Analyzing data manually is also subjective and can result in variation, which can lead to the wrong conclusion. In addition, to the best of our knowledge, no one has ever developed a software nor an algorithm to automate the quantification of birefringence images. In the past, we trained a convolutional neural network (CNN) to automate the process but CNN did not yield reliable and high accuracy outcomes. For those reasons, we decided to apply image analysis techniques such as background contrast and several built-in functions on MATLAB while keeping the CNN predictions to enhance the final results. This novel approach has delivered better results than using CNN alone. The developed algorithm is able to discard noises that are usually mislabeled as zebrafish by the CNN and thus increasing the accuracy of the mean gray value. We believe our method will one day be the new standard in evaluating and quantifying birefringence images in the field of biomedical research.

1023. The Role and Regulation of TRP53 in the Oocyte's Response to Radiation-induced Damage

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Monique Mills, Chihiro Emori, Zachary Boucher, Parveen Kumar

Faculty Mentor: Ewelina Bolcun-Filas

Abstract: Genotoxic treatments, including radiation, can deplete the ovarian reserve of primordial follicles (PFs) leading to infertility and endocrine dysfunction. This research aims to elucidate the DNA damage response (DRR) in PFs to understand the mechanisms that eliminate PFs during genotoxic treatment. CHEK2 kinase and its target TAp63 are key mediators of DDR in oocytes. TRP53, a target of CHEK2 in all cell types is considered non-essential for oocyte elimination. To identify factors involved in radiation-induced oocyte elimination, we conducted bulk and single-cell RNA-sequencing of irradiated and non-irradiated ovaries from wild-type and Chek2-/- mice. RNA-sequencing identified Differentially Expressed Genes (DEGs) (FDR<0.05) in wild-type but not Chek2-/- ovaries (83 Bulk, 125 single-cell). Analysis of DEGs revealed activation of the p53 pathways in irradiated ovaries (Bulk-RNAseq) and oocytes (scRNA-seq). To determine if TRP53 can contribute to PF elimination, TAp63A/ATrp53-/- ovaries were treated with a higher dose of IR, a dose at which loss of TAp63 activity does not prevent oocyte death. TAp63A/ATrp53-/- ovaries had improved PF survival (83.99%±13.38) compared to PF-depleted controls (3.67%±4.15), confirming that upon higher load of DNA damage TRP53 is activated and participates in PF elimination. Analysis of TRP53 activation after high-dose radiation revealed a larger form of TRP53 (~64 kDa) expressed only in purified oocytes. This suggests an oocyte-specific mechanism that regulates TRP53 pro-apoptotic activity. Follow-up studies will define mechanisms regulating TRP53 activity in ovaries. Thus, improving our understanding of how genotoxic treatments lead to PF loss and facilitating the development of fertility preservation strategies.

1024. Tagging Gα with Green Fluorescent Protein(GFP)

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): John Cyrus, Matthew Scandura, Joshua Kelley

Faculty Mentor: Joshua Kelley

Abstract: G-protein-coupled receptors (GPCRs) are a group of membrane proteins that detect the presence of nutrients in their environment, or signals from other cells. The coupled G-protein consists of three subunits: α, β, and γ. The Gα moves away from the β and γ sections when activated, initiating downstream signaling. We are interested in understanding how Gα signals in time and space. Typically, proteins of interest would be fluorescently tagged, however, GFP fusions at either end of the protein disrupt Gα function. We intend to study the Gα signaling by inserting GFP at an internal site that will maintain function.
Rosetta fold AI based structure prediction was used to assess the likelihood of a functioning Gα at different insertion sites with various linkers, flexible or rigid, short, intermediate, or long. Two Gα constructs, with inserts at different internal sites with different linkers were chosen and inserted into Saccharomyces cerevisiae. These were tested for functionality in live cells. Insertion sites showed fluorescence upon exposure to pheromone showing a functioning Gα. We intend to check other sites and linker combinations to determine if there is an optimal location that will produce maximum fluorescence. We intend to check out some of the sites that the simulations showed would not work to determine if this is the case. This project adds another tool that cell signaling researchers can use to track pathways and function in the cell.

1025. Antimicrobial Agent Cetylpyridinium Chloride Inhibits Mammalian Immune Cell Function: Dissection of Underlying Molecular Mechanisms

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Bright Obeng, Dorothy Smith, Lucas J. Bennett, Bailey E. West, Patrick J. Fleming, Christian M. Potts, John E. Burnell, Collin Frangos, Marissa D. Paine, Jessie Bruno, Juyoung Shim, Julie Gosse

Faculty Mentor: Julie Gosse

Abstract: Cetylpyridinium chloride (CPC) is a positively-charged antimicrobial used widely in consumer products and agricultural processes at concentrations up to 3 millimolar, exposing much of the U.S. populace to significant levels of CPC. There is minimal information on CPC's eukaryotic toxicology; hence, research is urgently needed. Ubiquitous throughout the human body, mast cells are implicated in many diseases and key players in normal immune and nervous system functioning. We have demonstrated that low-μM doses of CPC potently inhibit the antigen (Ag)-stimulated functions of RBL-2H3 mast cells, including degranulation. We have investigated the molecular mechanism underlying CPC inhibition of degranulation. CPC drastically inhibits Ag-stimulated store-operated Ca2+ entry (SOCE) into the cytosol, a core mediator of the degranulation pathway. Inhibited SOCE may be caused by CPC's inhibition of Ca2+ efflux from the endoplasmic reticulum (ER) into the cytosol, a trigger of SOCE. Early tyrosine phosphorylation events trigger these Ca2+ dynamics. Using In-Cell Western, global tyrosine phosphorylation was inhibited by CPC. A more detailed probe using Western Blot showed that CPC inhibits tyrosine phosphorylation, including that of Syk and LAT. Analysis with ELISA confirmed that CPC inhibits the phosphorylation of Syk. This inhibition of tyrosine phosphorylation events by CPC may explain CPC’s inhibition of SOCE and, hence, degranulation. This work provides molecular mechanisms underlying the effects of CPC on immune signaling and signaling pathways with shared elements in disparate cell types.

1026. Defining the Role of Src Kinase in Activation of the MAPK/ERK Signaling Pathway During JCPyV Infection

Submission Type: Presenter

Submission Category: Biomedical Sciences

Author(s): Lauren Cusson, Remi Geohegan, Sophie Craig,

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) infection is established in approximately 50-80% of the adult population, as a persistent asymptomatic infection of the kidneys. In immunocompromised individuals, the virus can spread to the CNS, cause a lytic infection, and progress into the fatal demyelinating disease, progressive multifocal leukoencephalopathy (PML). There are currently no approved treatments for PML, and thus it is critical to better define viral infection of host cells to identify potential treatments. Successful JCPyV infection relies on the manipulation of the mitogen activated protein kinase pathway (MAPK), which is responsible for relaying extracellular mitogenic signals into the cell to allow for the proper cellular response. The specific activation of the MAPK pathway upon JCPyV infection has yet to be fully understood. To define how the MAPK pathway becomes hijacked by JCPyV, the goal of this project is to determine whether Src, a tyrosine kinase known to activate the MAPK pathway, is required for activation of MAPK during JCPyV infection. SVGA cells treated with a chemical inhibitor or a silencing RNA (siRNA) targeting Src were subjected to JCPyV infection and analyzed using viral infectivity assays. It is hypothesized that Src knockdown will negatively impact JCPyV infection. Taken together, this research will help to better define virus-induced cell signaling mechanisms that lead to viral infection and identify potential targets and drugs for PML treatment.

1027. Neuronal Control of Bone Marrow Cell Populations

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Olaleye Olajuyin, Audrie Langlais,

Faculty Mentor: Katherine Motyl

Abstract: TRPM8 (Transient receptor potential cation channel subfamily M member 8) is a member of the transient receptor potential (TRP) family. It is activated by cold temperatures and cooling compounds such as menthol. TRPM8 is expressed in sensory neurons and has been implicated in a variety of physiological processes, including thermoregulation and neurogenic inflammation.
Our lab discovered that Trpm8-/- male mice have low vertebral bone volume fraction and decreased trabecular thickness determined by micro-computed tomography, but the cause of which is unknown. To study the role of TRPM8 in regulating bone homeostasis, our lab identified the changes in osteoclast and osteoblast cell differentiation from Trpm8-/- knock mice. Osteoblasts differentiate from bone marrow Mesenchymal Stem/Stroma Cells (MSSCs), many researchers have demonstrated TRPM8 expression in both primary human MSSCs and murine cell lines. This suggested that changes in MSSCs renewal and osteoblast differentiation could be the cause of bone loss. We cultured bone marrow stromal cells (BMSCs) to see if MSSCs are altered in Trpm8-/- mice. Trpm8-/- mice exhibit less colony development when compared to wild-type controls.
My current rotation project is to test the hypothesis that TRPM8 alters bone density by modulating the bone marrow progenitor cell function, I will be testing this hypothesis through RNA isolation, gene expression, and analyzing the bone marrow cells population of Trmp8-/- mice using flow cytometry. Our lab also created a Trpm8f/f mouse. Part of my project is to also confirm the exact location of the loxP sites within Trpm8f/f mice by DNA sequencing

1028. Defining Whether Calcium-signaling Inhibitors Reduce JCPyV Infection

Submission Type: Exhibit

Submission Category: Biomedical Science

Author(s): Nathaniel Jordan, Amanda L Sandberg, Avery C.S. Bond

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) infects about 80% of the global population and establishes a life-long, asymptomatic infection in the kidneys. However, in immunocompromised individuals, infection can spread to the central nervous system and infect glial cells within the brain. This causes a fatal disease known as progressive multifocal leukoencephalopathy (PML), which currently has no approved treatments and is a devastating disease. Thus, research into drug therapy for treating JCPyV is of the utmost importance. Preliminary data in the Maginnis Lab have demonstrated that calcium signaling possibly plays a role in JCPyV infection. Therefore, the goal of this project is to define whether JCPyV infection is reduced when host cells are treated with drugs that interfere with calcium signaling pathways. The calcium inhibitor tetrandrine was investigated because it has been shown to reduce infection of other polyomaviruses, such as simian virus 40 and Merkel cell polyomavirus. Tetrandrine is known to block the cellular influx of calcium through T-type and L-type calcium channels. To test whether tetrandrine blocks JCPyV infection, glial cells (SVGA cells) were treated tetrandrine, and infectivity was measured by indirect immunofluorescence. Results indicate that tetrandrine does not inhibit JCPyV infection, suggesting that JCPyV does not require the T-type and L-type calcium channel signaling pathways for infection. This research furthers our understanding of which cellular signaling pathway components are necessary for JCPyV infection.

1029. Opioid-induced Bone Loss may be mediated by Changes in miRNA Expression

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Audrie Langlais, Adriana Carvalho, Nicholas Farina

Faculty Mentor: Katherine Motyl

Abstract: Opioids remain the primary treatment for musculoskeletal pain. However, accumulating research suggests opioids pose a serious risk to bone health by increasing fracture risk. While the mechanisms behind this relationship are not well understood, our lab previously found an association between morphine-induced micro RNAs (miRNAs) upregulated in serum and reduced target gene expression in bone. This suggests opioid-induced circulating miRNAs may contribute to bone loss. The goal of this study therefore was to determine if the previously identified miRNAs were differentially expressed directly within the bone of morphine-treated mice. We treated 8-week-old C57BL/6J male mice with morphine (17 mg/kg bodyweight) via osmotic mini pumps or vehicle (0.9% saline) for 4 weeks. Bone marrow from the tibia was collected and miRNA was isolated for qPCR analysis. miRNA expression was normalized to the combined average expression of all miRNAs. We confirmed that the top 3 upregulated (miR-484, miR-223-3p, and miR-328-3p) and top 3 downregulated circulating miRNAs (miR-200b-3p, miR-28a-3p, and miR-182-5p) are expressed in tibia bone marrow. Recapitulating circulating expression levels, both miR-484 and miR-328-3p were significantly upregulated, while miR-200b-3p was significantly downregulated in morphine-treated mice, suggesting that these miRNAs may play a role in bone turnover. Future studies will investigate the tissue source of circulating miRNAs, mechanisms by which morphine alters miRNA expression, and how the miRNAs we identified regulate gene expression in bone. Together, this work will critically expand our understanding of how opioids impair bone and may influence future clinical prevention and treatment strategies.

1030. Notch Signaling Regulates PVAT Phenotype and Function

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Chenhao Yang, Xuehui Yang

Faculty Mentor: Lucy Liaw

Abstract: Obesity is an established risk factor for cardiovascular diseases (CVD) and paracrine signaling between adipose tissue and blood vessels is likely to influence disease progression. As a component of the vasculature, perivascular adipose tissue (PVAT) is a critical regulator of vascular function.Notch signaling which has a broad role in embryonic development, also plays a crucial role in regulating metabolic homeostasis. Notch signaling overactivation leads to reduced mitochondrial respiration in PVAT and increased contraction of PVAT-adjacent blood vessels. We generated a transgenic conditional model of Notch1 constitutive activation in mature adipocytes using an Adipoq-Cre driver and examined PVAT's physiology and function of PVAT-adjacent vessels in Ad/N1ICD mice compared to control non-Cre mice. We studied Notch's regulation on PVAT phenotypes and function. In vitro, Ad/N1ICD differentiated PVAT exhibited a significant decrease in mitochondrial respiration and ATP production rates compared to control cells. We also found that there were significant changes in expression of signaling components of mitochondrial fission and fusion biogenesis, and PINK1 mitophagy pathway in Ad/N1ICD PVAT compared with control groups as demonstrated by proteomics and immunoblot data. Moreover, vessel wire myography data revealed that PVAT-adjacent aorta from Ad/N1ICD mice showed significant increased vasocontraction compared to the aorta from control mice. In conclusion overactivation of Notch signaling could lead to impaired mitochondrial function in PVAT and altered vasoactivity of PVAT-adjacent blood vessels. This study advances our knowledge on how PVAT metabolism could regulate vasculature health.

1031. Hepatic Signaling Effects on Adipose Tissue Mest and Fat Mass Expansion

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Madeleine Nowak, Rea Anunciado-Koza

Faculty Mentor: Robert Koza

Abstract: Obesity can augment an individual's risk for the development of type 2 diabetes, cardiovascular disease, cancer, and dementia. The development of obesity is complex and is influenced by the inherent characteristics of a patient's sex, genetic background, demographics, and level of physical activity. Epigenetics, where DNA function is altered without changing the sequence, is another compounding characteristic. Mesoderm specific transcript (Mest), a gene regulated by epigenetics, shows inter-individual variability in expression in white adipose tissue (WAT) within a population of genetically identical mice that corresponds with increased risk and subsequent development of obesity. It is currently unknown what drives inter-individual differences in WAT Mest in mice; however, its consistent expression across all WAT depots within an individual implies the existence of a universal driver involved in its regulation. Re-analysis of liver microarray data generated in a previous study, as well as new results, show a strong inverse correlation between hepatic Enho (Energy Homeostasis Associated) and WAT Mest expression. Enho encodes adropin, a circulating hepatokine, which could be this universal driver. To further test this, we will determine the association between circulating serum adropin levels and adipose Mest expression in mice fed a high fat diet. We hypothesize that mice with high circulating adropin will show reduced fat mass expansion and obesity over the course of high fat diet feeding via downregulation of adipose Mest. Ultimately, we aim to determine if adropin is an early predictive marker for the development of obesity and metabolic dysfunction.

1032. Evaluating eDNA Metabarcoding as a Mic-roe-scopic Net to Catch Salmon Pathogens

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Noah Burby, Benjamin King, Michael Kinnison

Faculty Mentor: Erin Grey

Abstract: Wild Atlantic salmon in the Gulf of Maine (GOM) is a Distinct Population Segment (DPS) that has been listed since 2000 as endangered by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA). The current challenge is year-over-year decreases in the number of mature salmon returning to the Penobscot River for reproduction. Analysis of pathogen presence could allow for the identification of infection and the application of corrective measures. Environmental DNA (eDNA) is simply DNA that is collected from environmental samples (e.g., water, air, and soils), which consists of whole microorganisms and genetic material shed from macroorganisms (feces, skin, gametes, etc.). Purifying, testing, sequencing, and analyzing eDNA can help us rapidly identify the presence of these organisms in the sample. This project evaluates current methods' ability to detect salmon parasites from eDNA samples. Using computer-based alignment analysis, I first verified the potential of published primer sets to amplify known pathogen genomes. Then, I tested amplification in vitro via quantitative PCR (qPCR) assay with gBlocks of target parasites. After verifying these genes' amplification, I used DNA metabarcoding data from index sites (estuarine locations along the Maine coast where samples are routinely collected for Maine-eDNA) to determine whether these pathogens were present. The metabarcoding analysis results will help identify the presence of these pathogens. Continued monitoring using this novel approach will further the goals of protecting the GOM Atlantic salmon DPS to survive in its native habitat.

1033. Effects of Developmental Thyrotoxicosis on Reward-Related Gene Expression

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Logan Douglas

Faculty Mentor: Arturo Hernandez

Abstract: Alterations to brain regions controlling reward carry consequences for vulnerability or resistance to natural reward such as food, but also substances of abuse such as alcohol. Developmental disruptions in thyroid hormone status have severe consequences for neurological outcomes and brain function, and could also influence the development of brain reward areas. During neonatal life, Dio3, the gene coding the enzyme which breaks down thyroid hormone, is transiently expressed at high levels in reward system regions such as the nucleus accumbens (NAc) and the bed nucleus of the stria terminalis (BNST), as well as in the amygdala. This transient need to limit neonatal thyroid hormone action in these brain regions suggests a role for thyroid hormones in their functional programming, with potential consequences for reward system physiology and addictive behaviors. This research uses a Dio3 global KO mouse model to investigate abnormalities in the expression of molecular determinants of the reward system, as well as addictive and compulsive behaviors. These experiments will provide a better understanding of the consequences of developmental overexposure of thyroid hormone on neural reward and the potential effects on brain and behavior. This may also have important implications for the susceptibility to obesity and the etiology of addiction.

1034. YY1 Knockdown Improves CAR-T Therapy by Downregulating Checkpoint Axis

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Emily Irvine

Faculty Mentor: Mumtaz Yaseen Balkhi

Abstract: CAR-T cell therapy has been proven an effective therapy in B Cell malignancies, but challenges remain in terms of success against solid tumors due to restricted tumor access and activation induced T cell exhaustion. Exhaustion is induced when a T cell is chronically stimulated. Exhausted T cells upregulate checkpoint receptors, which ultimately turn off the T cells' killing activities. It has been shown that the transcription factor YY1 is responsible for this upregulation of checkpoint receptors. We hypothesize that through knockdown of YY1 using YY1 specific shRNA, this will lead to downregulation of checkpoint receptors and with that, the reversal of CAR-T exhaustion. We cloned YY1-shRNA in CEA tumor antigen targeting CAR vector and expressed that in activated human T cells utilizing lentiviral transduction method. After 3 days of culture, T cells were assessed for CAR and checkpoint receptor expression using Flow Cytometry. The YY1 knockdown was assessed using Western Blotting. Results showed a 50% modification of T cells with CAR and a 9.5% reduction in checkpoint receptor expression. Western Blotting confirmed the knockdown of YY1. These results indicated that checkpoint receptor expression is regulated by YY1. Further testing is required such as co-culturing of anti-exhaustion CAR T cells with tumor cells to compare tumor killing. Development of exhaustion resistant CAR T therapy could improve tumor killings as well as controlling chronic infections such as HIV.

1035. Early Life Exposure to Broccoli Sprouts Confers Stronger Protection against Enterocolitis Development in an Immunological Mouse Model of Inflammatory Bowel Disease

Submission Type: Poster

Submission Category:

Author(s): Lola Holcomb

Faculty Mentor: Sue Ishaq

Abstract: Inflammatory Bowel Diseases (IBD) are chronic conditions characterized by inflammation of the gastrointestinal (GI) tract that burden daily life, result in complications, and disrupt the gut microbiome. Many studies on diet and IBD in mice use an ulcerative colitis model, despite the availability of an immune-modulated Crohn's Disease model. The objective of this study was to establish IL-10 deficient mice as a model for studying the role of dietary broccoli and broccoli bioactives in reducing inflammation, modifying the immune response, and supporting GI tract microbial systems. Interleukin-10-knockout (IL-10-ko) mice on a C57BL/6 background, beginning at age 4 or 7 weeks, were fed either a control diet or one containing 10% raw broccoli sprouts. Diets began 7 days prior to inoculation with Helicobacter hepaticus, which triggers Crohn's-like symptoms in these immune-impaired mice, and ran for 2 additional weeks. Broccoli sprouts decreased ($p < 0.05$), fecal lipocalin (LCN2), a biomarker for intestinal inflammation, and fecal blood, diarrhea, and overall Disease Activity Index. Sprouts increased gut microbiota richness, especially in younger mice ($p < 0.004$), and recruited different communities in the gut (B-diversity, ANOVA, $p < 0.001$), especially in the colon (B-diversity, ANOVA, $p = 0.03$). The control group had greater prevalence and abundance of otherwise commensal bacteria which trigger inflammation in the IL-10-ko mice. Helicobacter was within the top-5 most prevalent core genera for the control group, but was not within the top-5 for the broccoli group. Disease parameters and microbiota changes were more significant in younger mice receiving broccoli. A diet containing 10% raw broccoli sprouts may be protective against negative disease characteristics of Helicobacter-induced enterocolitis in IL-10-ko mice, and younger age is the most significant factor (relative to diet and anatomical location) in driving gut bacterial community richness and similarity. The broccoli diet contributes to prevalence and abundance of bacterial genera that potentially metabolize dietary compounds to anti-inflammatory metabolites in the gut, are bacteriostatic against pathogens, and may ease disease severity.

1036. The Effect of Antimicrobial Treatment on Co-infections of Candida albicans and Group B Streptococcus.

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Griffin Lawrence, Katie Patenaude

Faculty Mentor: Melody Neely

Abstract: One of the most common causes of infant mortality is when a pregnant mother is colonized with Group B Streptococcus (GBS) in the vaginal tract and subsequently passes the bacteria to the neonate in utero or during delivery, resulting in a life-threatening bacterial infection. Since the vaginal tract is not a sterile environment, many other organisms may also be present. An organism that is often found co-colonizing the vaginal tract with GBS is the fungus Candida albicans, which often causes yeast infections. Therefore, we questioned whether GBS and C. albicans may interact with each other and if that interaction affects growth or virulence. Our preliminary data demonstrates that when C. albicans and GBS are co-cultured in nutrient poor media, GBS growth is increased compared to when GBS is grown alone. The focus of this proposal is to determine how interactions between these two organisms can affect the response to common antibacterial and/or antifungal treatments, both in vitro and in vivo using a zebrafish model. The aims of this project will explore two questions, (1) will the antifungal caspofungin show a decrease in effectiveness when both GBS and C. albicans are present, and (2) can we treat a GBS/C. albicans co-infection with a combination of antibiotics and antifungals? The results from these analyses will have clinical implications by providing new knowledge on treatment effectiveness during infections when both GBS and C. albicans are present.

1037. Environmental Arsenic Exposure and Mutations in Kruppel-like factor 9 Negatively Impact the Innate Immune Response to Influenza A Virus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Haley Foreman, Julianna Grampone, Brandy-Lee Soos

Faculty Mentor: Benjamin King

Abstract: Influenza A virus (IAV) infects up to 41 million people annually in the US, causing acute respiratory symptoms and approximately 52,000 deaths. Disease severity varies between individuals due to a likely combination of genetics and environmental factors. A known environmental hazard, particularly in Maine, is arsenic. Epidemiological and animal model studies suggest that early life exposure to arsenic alters the immune response, resulting in lengthy or excessive inflammation and lung damage following exposure to respiratory viruses later in life. Furthermore, available evidence indicates that arsenic disrupts the endocrine pathway that interferes with glucocorticoid receptor (GR) signaling, a critical regulator of inflammation. Currently, significant gaps remain in our understanding of how arsenic disrupts GR signaling and promotes inflammation. Kruppel-like factor 9 (klf9) is a regulator of the glucocorticoid signaling pathway and can modulate inflammation. How klf9 contributes to innate antiviral immunity and inflammatory response mechanisms is poorly understood. Using a zebrafish model of IAV infection and a klf9 knockout, we are studying how klf9 and arsenic exposure alters inflammation and the innate immune system in response to influenza infection. We hypothesize that environmental arsenic increases viral disease severity by inhibiting klf9-mediated down-regulation of numerous genes that orchestrate the inflammatory response to viral infection, leading to excessive inflammation. Using quantitative real-time PCR (qRT-PCR) we are studying genetic targets of klf9. Our qRT-PCR investigation of klf9 expression, as well as other GR-regulated genes, will enhance our understanding of the anti-inflammatory GR-klf9 signaling pathway and its interactions with both IAV and arsenic.

1038. Controlling Spatial Arrangement of Bacterial Cells through Surface Modification

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Anna Briley

Faculty Mentor: Caitlin Howell

Abstract: Bacterial physiology and biofilm formation are critical areas of study for researchers, including interspecies interaction, cell motility, antibiotic resistance, and more. However, methods of controlling the location, spacing, and density of bacterial clusters for experiments can be difficult to scale up. In this study, we aimed to develop a simple and cost-effective method for patterning surfaces to better control the spatial arrangement of bacterial cells on a large scale. We physically modified surfaces to have a nanopatterned structure containing rows of peaks and valleys. Some surfaces were further modified with a slippery liquid coating to control bacterial adhesion. It was hypothesized that bacteria would preferentially adhere to the valleys of patterned surfaces and the peaks of slippery, patterned surfaces. Microscopic imaging of surfaces exposed to E. coli expressing green fluorescent protein was used to characterize bacterial growth patterns between the different types of surface modifications. The preliminary results suggested that control could be achieved using slippery, patterned surfaces, supporting our hypothesis. This has significant implications for the study of bacterial physiology and highlights the potential of large-scale nanopatterning to improve control over bacterial adhesion.

1039. The Toxic Irony of Pharmaceutical Agent Cetylpyridinium Chloride; An ELISA and Molecular Dynamics Examination of Tyrosine Phosphorylation and Lipid Interactions in Mast Cell Immune Response

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Patrick Fleming, Bright Obeng, David Winski, Dylan Wagner, Lucas Bennett, Dorothy Smith

Faculty Mentor: Julie Gosse

Abstract: Cetylpyridinium chloride (CPC) is a cationic quaternary ammonium antimicrobial used widely in personal care and food products, despite the lack of literature assessing its eukaryotic toxicology. It is necessary to weigh the risk-to-benefit ratio of this antimicrobial agent. Mast cells (MC) are key players in the immune system, and their immune response degranulation is the release of effector compounds such as histamine. The degranulation signal transduction pathway depends upon on a series of molecular events: antigen binds to IgE receptor FceRI, triggering a cascade of tyrosine (Y) phosphorylation via Src-family kinases Lyn and Syk, leading to the enzymatic cleavage of the key eukaryotic membrane phospholipid phosphatidylinositol 4,5-bisphosphate (PIP2), generating IP3 which binds its receptor on the endoplasmic reticulum, inducing calcium mobilization, leading to downstream degranulation. Previous work in our lab shows CPC inhibits degranulation, disrupts calcium mobilization, and interferes with PIP2. Evaluation of upstream events, including phosphorylation and PIP2 interference, are needed for detailing biochemical mechanisms of CPC toxicity. ELISA and Western Blotting both show that CPC inhibits antigen-stimulated Syk phosphorylation. Our data to date indicate that CPC, conversely, does not affect tyrosine phosphorylation of Lyn, which contains both positive- and negative-regulatory tyrosine phosphorylation sites. However, low antigen dose conditions suggest a CPC-induced dysregulation of Lyn Y507, the inhibitory Y. Molecular Dynamics software GROMACS found that divalent cation Ca2 disrupts self-clustering of PIP2 lipids and attractive forces between PIP2 and positively charged amino acids in protein. These findings contribute to pin-pointing the mechanism underlying CPC disruption of immune cell function.

1040. Characterization of the Yeast Saccharomyces pastorianus Digestive Enzyme Alpha-galactosidase

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Haley Foreman, Emily Ledue, Katelyn Amero, Patrick Fleming, Sarah Foust, Nelson Goyette, Arianna Hatt, Emily Irvine, Daniel Joy, Timber Mattson, Brandon Rockwell, Robin Southwick, Katherine Southworth, Allison Weymouth

Faculty Mentor: Jennifer Newell-Catio

Abstract: α–Galactosidase (α-Gal) is a lysosomal enzyme responsible for the removal of terminal α-galactose residues from polysaccharides, glycolipids, and glycoproteins. Defects of α-Gal result in development of Fabry's disease, an X-linked genetic disorder that affects 1 in 40,000 males. Most patients have a single point mutation in the GLA gene that causes the disease. Mild phenotypes of the disease include vascular degradation and cardiovascular abnormalities, while total enzymatic loss results in a range of organ dysfunction documented in extreme cases. Fabry's disease is currently only treatable with enzyme replacement therapy. Successfully characterizing a novel α-Gal equips researchers for further study of Fabry's disease through investigation into defective α-Gal enzymes using recombinant expression. α-Gal activity was measured to investigate the effects of temperature, pH, metals, and inhibition by lansoprazole and phenylmercuric acetate. These results show that the S. pastorianus derived α-Gal is suitable for use in biomedical applications.

1041. Purification and Characterization of α-Galactosidase from Saccharomyces pastorianus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Haley Foreman, Emily Ledue, Chloe Bossow, Olivia Brunetti, Wyatt Cannell, Loren Genrich, Sarah Macleod, Hannah Maurais, Hector Orellana, Aiden Pike, Harjot Singh, Dorothy Smith, Morgan Tasker, Ben Vetelino

Faculty Mentor: Jennifer Newell-Caito

Abstract: α-Galactosidase (α-Gal) is a glycoside hydrolase responsible for the liberation of terminal galactose residues from oligo and polysaccharides. α-Gal is a lysosomal enzyme in humans, necessary for the degradation of various sugar-modified substrates. Likewise, α-Gal is utilized industrially to break down unwanted sugars in the processing of food products. Although it has been acutely studied in select organisms, there is limited understanding of the characteristics of α-Gal from a variety of species. Similarly, an easily producible α-Gal isozyme which is optimal for industrial use and the modeling of human disease is yet to be characterized. Here, we purify and characterize α-Gal from Saccharomyces pastorianus to expand pan-organismal knowledge of the hydrolase. In order to increase α-Gal production, growth conditions in flask culture were monitored using the Lowry Assay, an activity assay using p-nitrophenyl-α-D-galactopyranoside, and sodium dodecyl-polyacrylamide gel electrophoresis (SDS-PAGE). α-Gal was purified through a combination of ion-exchange and affinity chromatography until a single band was seen by SDS-PAGE. The enzyme will be characterized via salinity and the inhibitors merbromin and deoxynojirimycin. These results help inform a better understanding of α-Gal and could lead to its improved industrial and biomedical application.

1042. D2 Haplotype at Chr13 QTL-Mapped Region Exhibits Higher Trim28 Binding at Trans-Targets

Submission Type: Exhibit

Submission Category: Biomedical Sciences

Author(s): Arad Bustan, Anna Struba

Faculty Mentor: Christopher L. Baker

Abstract: In previous research, a BXD mESC mapping panel was utilized to map trans-acting regions of the mouse genome that impact chromatin accessibility and gene expression. Notably, a region on Chr13 was identified as having a dominant-repressive effect on trans-targets corresponding to the D2 parental haplotype. This region is enriched for Krüppel-Associated Box Zinc Finger Proteins (KZFPs), repressing expression of transposable elements through Trim28 activity and heterochromatin-promoting mediators. Based on these findings, we hypothesized that the D2 haplotype at our Chr13 QTL-mapped region would exhibit higher Trim28 binding at our Chr13 QTL-responding targets. To test this hypothesis, we conducted Trim28 ChIPseq for both parental and Chr13-QTL congenic (N7) mESCs and analyzed the data bioinformatically using RStudio.
Our analysis confirmed that higher Trim28 binding at trans-targets occurred with the D2 haplotype. Additionally, the data supported previous research that showed the activity of Trim28 in reprogramming is associated with differential enrichment of zinc finger proteins involved in pluripotency and cell cycle. Since Trim28 plays a role in various cellular mechanisms, identifying genomic differences may be crucial for understanding complex diseases.
Overall, our findings suggest that the D2 haplotype at the Chr13 QTL-mapped region has a greater impact on the regulation of transposable elements through Trim28 activity. This knowledge could potentially aid in the development of new treatments for diseases associated with the dysregulation of Trim28 activity.

1043. Interpretable Machine Learning for Knowledge Discovery on Sequence Data

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): John Shay

Faculty Mentor: Chaofan Chen

Abstract: Artificial intelligence (AI), and in particular, machine learning, have progressed rapidly in recent years and have been widely adopted in a number of application domains, including image recognition, clinical decision support, and autonomous driving, among others. However, decades of research have focused on how to make machine learning models more accurate, without considering how to make these models interpretable to human beings. Lack of interpretability, unfortunately, limits the use of machine learning for scientific knowledge discovery, because we humans are unable to understand the rationale behind predictions made by "black-box" machine learning models, and are therefore unable to extract scientific insight from these black-box models. In this project, we developed interpretable machine learning models and applied them to the mind wave sequences from the Brain-MNIST dataset, to demonstrate the potential of interpretable machine learning in advancing scientific inquiry.

1044. A Mechanically Enhanced Smart Cane for the Visually Impaired

Submission Type: Exhibit

Submission Category: Biomedical Sciences

Author(s): Melissa Ham, Annemarie Towle, Todd Crawford

Faculty Mentor: Robert Bowie

Abstract: Traditional white canes provide practical aid to facilitate travel and mobility for the visually impaired, providing tactile feedback through impacts and vibrations. Smart canes developed in the past have looked to improve the user's awareness by integrating sensors but have fallen short due to consumer desire for overhead feedback, as opposed to only advanced ground level detection. In addition, traditional white canes aren't suited for rough terrain and tend to get lodged in cracks, causing injury to the wrist and abdomen and deforming the cane. In response to these issues, a novel smart cane was developed to address their structural weaknesses and limited overhead feedback to fill the gaps left by smart canes that have neglected mechanical improvements. The team's design improves on the overhead issue by implementing a LiDAR sensor to detect both solid and non-solid objects with little observed difference in accuracy, with a 19mm × 9.5mm cross-sectional view capable of detecting objects up to 2m away. To tackle the issue of structural failure, the team is in the process of testing three unique prototypes which utilize various combinations of springs and magnets to engineer a joint that is able to absorb the shock from impacts. The final design will incorporate attributes with the highest performance as determined by the test results, to create a smart cane with the potential to prevent injuries by slowing impact speeds, as well as indicating an improved sense of environmental awareness for the user.

1045. Osteoclast specific deletion of β2-Adrenergic Receptor Limits Trabecular Bone Acquisition in Male, but not Female Mice.

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Rebecca Peters, Ryan Neilson

Faculty Mentor: Katherine Motyl

Abstract: The sympathetic nervous system regulates bone homeostasis through β-adrenergic receptor (βAR) signaling. Our lab has shown that this may be mediated in part through directly targeting the osteoclast. βAR antagonists (β-blockers) are currently being tested to prevent bone loss in postmenopausal women, therefore, understanding mechanisms of β2AR (the most abundantly expressed βAR) function in bone are critical. Previous studies of a β2AR global knockout documented a high bone mass phenotype at 6 months of age, but the specific role of β2AR in osteoclasts has not been investigated. To directly examine the effects of β2AR on osteoclasts in a mouse model, we developed an osteoclast-specific knockout of β2AR (β2AR-KO). Using μCT, we measured L5 vertebral and femoral bone microarchitecture of 8-week-old wildtype (+/+) and β2AR-KO male and female mice. In males, L5 trabecular bone parameters (bone volume fraction, bone mineral density, and trabecular thickness) were significantly lower ($p<0.05$). Trabecular parameters also tended to be lower in the femur, with a 10% reduction in BMD and 35% increase in SMI, indicating decreased bone strength. There were no changes in male cortical bone parameters, or in any female bone parameters. Overall, our findings show that osteoclast-specific deletion of β2AR causes reduced trabecular bone at 8 weeks of age in male mice, contrary to previous findings in a 6-month-old global knockout. This suggests the role of β2AR in bone may be age- and cell-dependent. Future studies will explore the osteoclast-specific role of β2AR using age and stress as models of primary and secondary osteoporosis.

1046. Investigating the Interdependent Relationship between Prophage and Group B Streptococcus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Brandon Rockwell, Caitlin Wiafe-Kwakye

Faculty Mentor: Melody Neely

Abstract: Group B Streptococcus (GBS) is an opportunistic bacterial pathogen commonly found in humans; however, in immunocompromised populations, GBS infections are often fatal. Analyzing the role of prophages (integrated viral genomes) may be advantageous in understanding and treating GBS infections. Prophages have been shown to influence the fitness and virulence of some bacterial species, although the role of GBS-specific prophages are not well known in this process. Previous work in the lab revealed a hemolysin-encoding bacterial gene that is differentially expressed when the prophage is present compared to the expression in a prophage-cured strain. This finding suggests that the prophage is playing a role in regulating bacterial genes that likely impact fitness and virulence. In this project, I will be investigating the following specific aims: (1) determine the function of the hemolysin toxin and (2) identify when the hemolysin gene is expressed. Aim 1 will be accomplished by using a suicide plasmid to delete the hemolysin gene from the bacterial chromosome and create a knockout mutant that is verifiable by further analyses. Aim 2 will involve cloning the hemolysin promoter into a reporter plasmid and conducting assays to test under what environmental conditions the toxin is being expressed. The overarching goal being to determine if hemolysin III is benefitting bacterial fitness as well as gaining a better understanding of the mechanisms of GBS infections.

1047. Establishing a High Throughput Screen for Genes Required to Activate Muscle Gene Expression Downstream of Low mTOR/Translation in C. elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Marissa Ruzga, Jordan Horrocks

Faculty Mentor: Aric Rogers

Abstract: Dietary restriction (DR) increases healthful longevity in multiple species, including C. elegans. In part, this is due to reduced signaling through the nutrient-sensing mechanistic target of rapamycin (mTOR) pathway resulting in reduced activity of the cap-binding complex (CBC) governing mRNA translation. One subunit of this complex is IFG-1, referred to as eukaryotic translation initiation factor (eIF)4G in mammals. Downregulating ifg-1 gene expression in the whole animal or selectively in certain tissues increases C. elegans longevity (Howard et al., 2021). We find that lowering ifg-1 preserves motility in a body-muscle proteotoxicity-induced paralysis model. Interestingly, lowering translation also increases expression of muscle-specific genes encoding structural and regulatory factors. We do not know whether these gene expression changes are merely associated with, or required for, improved muscle function in this model. Our goal is to develop a fluorescence reporter screen to identify genes required for increased muscle gene expression under low translation conditions, which can then be used to determine whether the enhanced muscle expression signature is required for enhanced proteostasis in this tissue. We will be using a GFP reporter strain driven by a promoter of the body muscle gene myo-3, which is upregulated in low translation conditions, as a tracer of the enhanced muscle expression signature. RNA interference (RNAi) will be used to suppress expression of each of the screened genes.

1048. Characterization of Manganese-Induced Neurodegeneration in C. elegans Treated with Winterberry Leaf Extract

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Brendan Moline, Sam Caito

Faculty Mentor: Jennifer Newell-Caito

Abstract: Neurodegeneration is a condition present in Alzheimer's disease (AD) and Parkinson's disease (PD) in which the cells of the nervous system experience loss of function and death. Around the world, each year PD and AD affect 6.2 million and 29.8 million people, respectively, with the exact causes remaining unknown. Manganese (Mn) is a transition metal which is essential for human survival in trace concentrations. However, abnormal concentrations can induce neurodegeneration through the accumulation of reactive oxygen species and the eventual onset of oxidative stress. An extract produced from winterberry leaves exhibits antioxidant properties as it has been shown to protect against Mn-induced oxidative stress in the nematode worm, Caenorhabditis elegans. To evaluate dopaminergic integrity and activity, worm strains were treated with several concentrations of winterberry leaf extract (WLE) and Mn. A motility assay with the wildtype N2 worm strain revealed a dose-dependent increase in movement upon treatment with WLE. This is expected in Mn-exposed worms pre-treated with WLE. Red fluorescence microscopy with inhibited dopamine biosynthesis (CB1112) and RFP-tagged dopamine receptor (VP596) worm strains may indicate protection from neurodegeneration by the extract. A 1-nonanol dopamine-dependent repulsion assay with the N2 and CB1112 strains may reinforce these findings as a greater percentage of worms pre-treated with WLE would repulse from 1-nonanol exposure faster than Mn-treated worms. Overall, the results suggest that pre-treatment with WLE offers Caenorhabditis elegans protection against Mn-induced dopaminergic neurodegeneration, supporting its potential as an alternative medicine which could be used to treat people affected by neurodegenerative disorders.

1049. Evaluating Serotonin-Receptor Specific Drug for Inhibition of JCPyV Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Stephen Rezack, Lucas Bennett

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) infects 50-80% of the human population, establishing a lifelong persistent asymptomatic infection in the kidneys. In immunocompromised individuals, such as those with HIV/AIDS or those taking immunosuppressant drugs, the virus can transverse from the kidneys to the central nervous system resulting in the demyelinating, fatal disease, progressive multifocal leukoencephalopathy (PML). The symptoms of PML include paralysis, altered cognitive function, and frequently leads to death. JCPyV infection of cells is established when the virus attaches to sialic acid receptors and enters the cells through clathrin-mediated endocytosis via 5-hydroxytryptamine serotonin type 2 receptors (5-HT2Rs). The mechanism by which JCPyV utilizes 5-HT2Rs is not fully understood. Fluoxetine, commonly known as Prozac ®, is a 5-HT receptor agonist that binds directly to 5-HTRs. I hypothesized that the 5-HTR agonist, fluoxetine, would inhibit infection of JCPyV by binding to serotonin receptors. To test this hypothesis, human embryonic kidney (HEK-293A) cells, engineered to express 5-HT2 receptors, were used to evaluate the impact of fluoxetine on JCPyV infection. Cells were treated with varying concentrations of fluoxetine or a control and infected with JCPyV, and infectivity was measured using a fluorescence focus assay. This research increases our understanding of viral interactions with cellular receptors and illuminates potential drug targets for treating PML, including fluoxetine, which is already FDA approved.

1050. Detecting the Effect of Genetic Diversity on Brain-Wide Cellular and Pathological Changes in AD-BXD Alzheimer's Disease Mouse Model

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Brianna Gurdon, Sharon C. Yates, Gergely Csucs, Nicolaas E. Groeneboom, Niran Hadad, Maria Telpoukhovskaia, Andrew Ouellette, Tionna Ouellette, Kristen O'Connell, Surjeet Singh, Tom Murdy, Erin Merchant, Ingvild Bjerke, Heidi Kleven, Ulrike Schlegel, Trygve B. Leergaard, Maja A. Puchades, Jan G. Bjaalie

Faculty Mentor: Catherine Kaczorowski

Abstract: Alzheimer's Disease (AD) is a complex neurodegenerative condition that currently has no cure and impacts millions around the globe. Even in the presence of neuropathology, there is significant variation in the age at symptom onset and severity of cognitive decline. Further characterization of pathology development including neurodegeneration, AD-specific pathology deposition, and neuroinflammation is needed to better understand the relationship between brain composition and this variation in clinical disease outcomes. We implemented the QUINT workflow to evaluate the immunohistochemistry output of neurodegeneration (NeuN), gliosis (Iba1 and GFAP), and amyloid beta pathology (AB1-42) among a panel of AD-BXD mice at adult and middle-aged time points. We recently expanded this method to allow for nonlinear refinement of brain atlas registration, and for quality control assessment of atlas registration and brain section integrity. Using this method we provide an expansive brain-wide characterization of diverse 5XFAD mice and 1). assess changes in cell and pathology composition between 6 and 14-month-old AD-BXD animals, 2). assess variation in cellular abundance among AD-BXD strains, and 3). interpret bulk RNAseq data with respect to cellular abundance. We observed near-global age-related increases in microglia, astrocyte, and amyloid-beta accumulation, while regional variation in neuron load existed among strains. By integrating hippocampal bulk RNA sequencing and imaging data, we demonstrated that ~15-35% of genes expressed are correlated with load and vary based on both cell type and age. Overall, we achieved high confidence regional output of AD-relevant cell types and pathology and also facilitated the exploration of genotype and cell composition relationships.

1051. Growth of the Zebrafish Pectoral Fin Skeleton is Inhibited by Paralysis Both During and Prior to Muscle Formation within the Pectoral Fin

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ryn Harrington, Teresa Easterbrooks

Faculty Mentor: Jared Talbot

Abstract: Contractile muscle movement promotes early skeletal formation. However, it is unknown what timeframe is the most influential for movement to drive skeletal development, or whether the movement must originate from muscle directly in contact with developing skeletal elements. We investigated this question using the zebrafish pectoral fin, which is homologous to the tetrapod forelimb, in order to better understand how lack of movement during development can lead to limb skeletal defects such as arthrogryposis. To identify the critical window for skeletogenic impact, we paralyzed zebrafish during different phases of development, beginning at 1 day post fertilization (dpf) before the pectoral fin has any contractile muscle and ending after muscle has developed and cartilage has been patterned (4 dpf). We pulse-treated fish with paralytic agents from 1-2 dpf, 2-3, dpf, and 3-4 dpf, and found muscle movement in each developmental period is needed for cartilage growth. Remarkably, the largest effect was seen when fish were paralyzed from 1-2 dpf, a period when cartilage is beginning to form, but the pectoral fin has no skeletal muscle fibers. This shows that movement is necessary for skeletal development before pectoral fin muscle is functional, and suggests that movement from core regions of the body drive development of the skeleton before muscle is present in the limb.

1052. Phenolic Extracts from Wild Blueberries Promote Collagen Remodeling During Wound Healing

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Tolu Esther Alaba, Julia Pitman

Faculty Mentor: Dorothy Klimis-Zacas

Abstract:

Introduction: Collagen remodeling is important for adequate wound healing. The amount, thickness, and arrangement of collagen within wounds determines the effectiveness of repair and the strength of the skin. Previously, our lab reported wound healing with anthocyanins and phenolics treatments. However, the pathways associated with the effect are yet to be explored.

Objective: Therefore, the objective of this study is to examine the role of phenolics and a mixture of phenolics and anthocyanins extracted from wild blueberries (WB) on collagen remodeling in rats' surgical wounds.

Methods: Phenolics (P) and mixed (M) fractions were extracted from WB by solid phase extraction, and their compositions were determined by HPLC. The extracts were resuspended in distilled water. Fifty-six Sprague-Dawley rats were classified into seven groups: 1. Control, 2. P250µg/ml, 3. P500µg/ml, 4. P1000µg/ml, 5. M250 µg/ml, 6. M500 µg/ml, and 7. M1000µg/ml. Dorsal wounds were created on all the rats and treated for 7 days according to the above treatment. Wound tissues were excised, fixed and stained for histological analysis. Tissues were imaged and observed for collagen quality using Qu path software.

Results: The results showed complete remodeling occurred in the P500µg/ml group with thick and dense collagen fibers arranged in a meshwork pattern when compared with the control.

Conclusion: This study has the potential to benefit patients with chronic wounds by developing wound healing products from wild blueberries. In addition, these healing products may aid the economic growth of blueberry farmers and the wild blueberry industry in the state of Maine.

1053. Role of Protein Tyrosine Phosphatase Receptor Type Q (Ptprq) in Podocyte Structure and Function

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Omodasola Adekeye, Daemon Dikeman, Ritu Tomar

Faculty Mentor: Iain Drummond

Abstract: The podocyte is the key unit of the kidney glomerular filtration barrier. Dysfunction of the podocyte is a major cause of proteinuria and a leading cause of end-stage kidney disease. Using a transcriptomic approach to identifying novel genes important for glomerular development, we identified protein tyrosine phosphatase receptor type Q (ptprq) to be highly enriched in the developing pronephric glomeruli of zebrafish. This gene is known to dephosphorylate phosphatidylinositol (3,4,5)-triphosphate(PIP3) to phosphatidylinositol (4,5)-biphosphate(PIP2) hence inducing and regulating PIP2-dependent signaling and plasma membrane protein localization. However, the relevance of Ptprq in the formation and regulation of podocyte structure and function remains unclear. Hence, we need to determine if Ptprq regulates glomerular slit diaphragm protein localization and signal transduction in developing podocytes. To confirm the expression of ptprq in the glomerulus of zebrafish larvae and detect the localization of Ptprq, we performed a whole mount in situ hybridization and immunohistochemistry. Additionally, we used the zebrafish CRISPR G0 screen to test the Ptprq function in glomerular development. Our CRISPR efficiency was validated using fluorescent polymerase chain reaction (PCR) and fragment analysis. Results showed that ptprq was expressed in the zebrafish glomerulus and antibody staining confirmed the presence of Ptprq protein in the zebrafish glomerulus. Knockout of ptprq led to whole-body edema, a phenotype associated with primary kidney failure. This suggests that Ptprq is likely to be involved in podocyte function. Our research would identify novel causes of genetic glomerular disease and help inform further analysis of human kidney disease.

1054. Exploring the Role of Reactive Oxygen Species Production in the Innate Immune Response to Influenza A Virus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Hannah Lembree, Eric Jestel, Silvia Wright, Keith Hutchison, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza A virus (IAV) is responsible for an estimated 12,000-52,000 deaths yearly in the United States from 2010-2020. Influenza vaccines are available but not always effective as multiple strains circulate through populations during any given year. Development of treatments to help individuals overcome an infection requires studies of the immune system. Zebrafish larvae are a vertebrate model to study how the innate immune system responds to influenza, as the zebrafish adaptive immune system does not develop until 2-4 weeks post fertilization. Neutrophils, important innate immune system cells, initiate an inflammatory response to infectious agents through the release of reactive oxygen species (ROS). ROS generation must be sufficient to clear pathogens through oxidative damage but not cause a hyperinflammatory response that may harm host tissues. Contrary to expectations, zebrafish with a myeloid peroxidase (mpx) gene knockout, essential for the production of ROS, have a higher survival rate when infected with IAV than wild type. Gene expression was assayed using RNA sequencing (RNA-Seq) in mpx knockout zebrafish at 12, 24, and 36 hours post infection with IAV and compared to uninfected vehicle controls. Analyses of the RNA-Seq data showed that genes in the mitogen activated protein kinase (MAPK) signaling pathway that drives neutrophil action, were upregulated at 12 hpi but downregulated at 24 and 36 hpi. Differentially expressed genes mapped to additional pathways involved with the response to IAV infection were found. Understanding differential gene expression in the zebrafish mpx knockouts will inform the development of new treatments for IAV.

1055. Utilizing Sulfloraphane from Broccoli to Treat IBD

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ryan Wijayanayake

Faculty Mentor: Sue Ishaq

Abstract: IBD is a gastrointestinal disease that affects millions of people around the globe annually, and is characterized by inflammation of the GI tract. The two major types of IBD – Ulcerative Colitis and Crones disease, are both incurable but may be treated with medication, which can be expensive and/or inaccessible to people worldwide.

Cruciferous vegetables, such as broccoli, cauliflower, and cabbage contain an inactive precursor that can create anti-inflammatory compounds, called Sulfloraphane. To activate the precursor, broccoli can be cooked, though the levels of Sulfloraphane vary depending on the method used to prepare the broccoli.

A study was done to test three different broccoli preparation methods – Raw Sprouts, Mild Heat, and Steamed to find which would yield the highest amount of Sulfloraphane. To test the anti-inflammatory abilities of each preparation method, an in vivo experiment was conducted. Mice groups with two different kinds of induced colitis, acute and chronic, were fed each preparation to perceive whether the Sulfloraphane would take effect.

In the future, I will be assisting with a continuation of the study. Through using qPCR and growth assays, we will confirm whether the bacteria from the mouse GI tracts are responsible for the production of anti-inflammatory compounds.

1056. Interactions Between Co-habituating Prophages Increases Expression of Mycobacterial Intrinsic Resistance Gene, whiB7

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sarah McCallister, Matt Cox, Jaycee Cushman, Keith Hutchison, Josh Kelley, Sally Molloy

Faculty Mentor: Sally Molloy

Abstract: Prophage, integrated viral genomes, are known to increase antibiotic resistance of bacterial pathogens. Non-tuberculosis mycobacteria such as Mycobacterium abscessus, causes pulmonary and disseminating infections that are often totally drug resistant. Most M. abscessus isolates carry one or more prophages but their role in intrinsic antibiotic resistance is not yet known. We have demonstrated that M. chelonae, a close relative of M. abscessus, has higher antibiotic resistance and expression of a conserved mycobacterial regulator of antibiotic resistance genes, whiB7, increases in the presence of two prophage genomes. The first prophage, McProf, only carries out lysogenic infection of M. chelonae. The second prophage, BPs, is capable of lysogenic infection but also undergoes induction and lytic infection. We hypothesize that BPs induction activates McProf gene products, such as polymorphic toxin systems, to increase expression of whiB7. We have demonstrated that strictly lytic infections by BPs increases whiB7 expression in the presence of McProf. Inhibiting BPs induction in the M. chelonae double lysogen (BPs, McProf) decreases whiB7 expression. We don't know whether whiB7 expression increases in the BPs induced cells or through signaling in neighboring lysogenic cells. To determine if BPs induction increases whiB7 expression in cis or in trans we have constructed M. chelonae strains with an mCherry-whiB7 promoter reporter and a BPs-GFP fluorophage that reports lytic gene expression. Using fluorescent microscopy, the double lysogen strain of M. chelonae (BPs, McProf) showed increased whiB7 expression compared to M. chelonae (McProf) control, M. chelonae single lysogen (BPs), and M. chelonae (no prophage).

1057. MYBL2 Coordinates Proliferation and Differentiation in the Developing Mammalian Cochlea.

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Caryl Young, Emily Burt

Faculty Mentor: Vidhya Munnamalai

Abstract: The cochlea is the auditory organ of the inner ear that has an asymmetric sensory epithelium named the organ of Corti (OC). The OC consists of one row of sound detecting inner hair cells (IHCs) and three rows of sound amplifying outer hair cells (OHCs). These HCs are susceptible to damage and are non-regenerative. Understanding how cells proliferate and differentiate in the cochlea will be important in developing potential regenerative therapies.

We define a role for MYBL2, a transcription factor, in patterning domains of proliferation and differentiation in the cochlea. Using in-situ hybridization we show MYBL2 enriched in the future inner sulcus (IS) domain, which attains non-sensory identity and continues to proliferate on embryonic day (E)14.5. Mybl2 abuts the JAG+, prosensory domain, comprised of cells that have exited the cell cycle and await cues to differentiate. Upon conditional knockout of Mybl2 proliferation is decreased as shown by Ki67. In addition, the size of the sensory domain, specified by JAG1, is increased at the expense of the IS. These data suggest that MYBL2 segregates the IS and sensory domain by repression of Jag1. On E18.5, Mybl2 cKO cochleas are shorter, however show additional, ectopic IHCs. We predict the decrease in length is due to a loss of proliferation, while the additional HCs are a result of the increased size of the JAG1 domain. In conclusion, MYBL2 is important for regulating proliferation and differentiation during development, and therefore may be capable of stimulating cell cycle re-entry and regeneration in the mature cochlea.

1058. CTHRC1 Inhibits Adipogenic Signaling

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Matthew Siviski

Faculty Mentor: Igor Prudovky

Abstract: The development of novel approaches to prevent obesity is imperative given that 2016 marked the first year in decades that the life expectancy for adults in the United States decreased, largely due to a rise in obesity-related comorbidities. The secreted factor, collagen triple helix repeat-containing 1 (CTHRC1), is a novel suppressor of white adipose tissue formation (adipogenesis). In order to elucidate the molecular mechanisms by which CTHRC1 suppresses adipogenesis, we have developed an in vitro model to study the effects of CTHRC1 on the expression levels of the adipogenic transcription factors that coordinate preadipocyte-to-adipocyte differentiation. Our data show that CTHRC1 suppresses both the transcript (mRNA) and protein expression levels of CCAAT/enhancer-binding protein delta (C/EBPδ), C/EBPα, peroxisome proliferator-activated receptor gamma (PPARγ), and other critical adipogenic transcription factors that give rise to a mature, lipid-rich adipocyte. In this context, our data suggest that CTHRC1 may function in part by increasing the expression of SRY protein box 9 (SOX9), a protein that suppresses adipogenesis by inhibiting the promoter regions of C/EBPβ/δ and their corresponding gene expression.

1059. Characterizing the Role of Calcium Inhibitors in JC Polyomavirus Infection.

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Olivia Brunetti, Avery Bond

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus is a ubiquitous, double-stranded DNA virus that affects most of the population worldwide. In immunocompromised individuals, the virus can spread to the brain and cause progressive multifocal leukoencephalopathy (PML), a fatal neurodegenerative brain disease. There is currently no approved treatment for JCPyV or PML, demonstrating the need to identify potential treatments. A large-scale drug screen was performed in the Maginnis Laboratory using a high-throughput In-cell Western assay with the National Institutes of Health Clinical Collections (NIH-CC) to identify possible drugs for the treatment of JCPyV infection. Several calcium inhibitor drugs were identified in the screen and proposed to reduce JCPyV infection, suggesting that calcium signaling pathways are necessary for JCPyV infection. The objective of this research is to determine if JCPyV infection can be reduced by cellular calcium flux inhibitors and to define the mechanism by which calcium flux inhibitors are reducing viral infection. Glial cells were treated with calcium inhibitors and analyzed via In-cell Western assays for alterations in cellular proteins known to be required for JCPyV infection, such as extracellular signal-regulated kinase (ERK). Results suggest that nifedipine, a L-type calcium channel blocker that prevents calcium ions from entering the cell, reduces JCPyV infection by also reducing phosphorylation of ERK, which is critical for infection. Identification of this and other possible calcium inhibitor drug targets is key to developing an approved treatment for JCPyV infection and PML.

1060. Characterizing the Regulation of Neutrophil Reactive Oxygen Species During Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sarah Foust, Brandy-Lee Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza A Virus (IAV) infection triggers neutrophil activity which generates reactive oxygen species (ROS) by the nicotinamide adenine dinucleotide phosphate oxidase 2 (Nox2) enzyme to clear infection. Nox2 is made of several subunits, like protein p47, which is encoded by neutrophil cytosolic factor 1 (ncf1) and is necessary to regulate neutrophil activity. ROS generation must be regulated; otherwise, it leads to hyper-inflammation and disease. Nuclear factor erythroid 2–related factor 2 (nrf2) is a transcription factor that activates the antioxidant response, indirectly mitigating ROS levels and preventing damage. Thus, we hypothesize that the activities of ncf1 and nrf2 act reciprocally during an IAV infection. To explore this regulatory interaction, we will generate transgenic zebrafish lines to image the expression patterns of ncf1 and nrf2 in infected fish and study the expression of downstream Nrf2 targets that could regulate ROS production. Using confocal microscopy, we will use our in vivo models to visualize interactions between ncf1, nrf2, IAV, neutrophils, and ROS.

1061. Characterizing the Effects of Aging on Nuclear Transport in Yeast

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Remi Geohegan, Dylan Madden

Faculty Mentor: Joshua Kelley

Abstract: The population of Americans 85 years old and over will triple by 2050 increasing the need for medical interventions and the study of age associated diseases. The age associated diseases Alzheimer's disease, Amyotrophic Lateral sclerosis (ALS) and frontotemporal dementia display defects in the primary regulator of nuclear transport, the small G-protein Ran. Regulation of transport of molecules across the nucleus is necessary for diverse processes, such as cell cycle progression, signal transduction and gene expression. Nuclear transport is also disrupted in the premature aging disorder, Hutchinson Gilford Progeria Syndrome (HGPS). Cells from HGPS patients display reduced heterochromatin associated with loss of Ran regulation (Figure 1). Baker's yeast serves as a model for studying aging due to the presence of highly conserved molecular pathways with humans. We have previously found that loss of heterochromatin in yeast results in dysregulation of Ran. The loss of gene silencing and compaction of heterochromatin have been observed in yeast as they age, suggesting dysregulation of transport and subsequent gene transcription. This project aims to characterize the effects of aging on nuclear transport in yeast, determining if yeast can serve as a model to study nuclear aging. We use a microfluidic aging chamber that traps individual yeast to monitor fluorescent Ran as the yeast age. We optimized the chamber and observed changes in cell morphology with aging. Future studies will test the effects of Ran regulation and chromatin structure on lifespan.

1062. Nanocellulose Based Foams For Low-Cost Disposable Medical Applications

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Dominic Kugell, Sydney Sheehan, Spencer Johndro

Faculty Mentor: Michael Mason

Abstract: Polyurethane foams have been a staple material for their use in medical positioners, such as post surgery elevation pillows as well as specific tailored positioners for their use during surgery. Polyurethane foams are preferred because of their lower cost, versatility, and suitable mechanical properties. However, the environmental impact, including both cost and perception, of these foams is immense. Therefore, alternatives are being explored with biopolymers emerging as a promising class of materials. Cellulose is one such polymer that has recently demonstrated desirable properties. Surgical infection rates have been exacerbated by the Covid-19 pandemic and the medical industry is combating this issue by exploring a significant increase in single use devices. This allows for a transformation of the medical industry via biomedical advancements by creating renewable, environmentally conscious biodegradable single use products. In this study, nanofibrillated cellulose (NFC), a household foaming agent, and a majority cellulose wood pulp (<88%), are combined to create a low density bio-foam. The goal of the work presented here is to develop and demonstrate a scalable green method for generating porous biodegradable cellulose based foam products. The resulting materials must demonstrate comparable mechanical, thermal, and rheological properties with current petroleum based materials.

1063. Manipulating Virulence of C. albicans Through Administration of RBT1 Peptides

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Meg Caron

Faculty Mentor: Robert Wheeler

Abstract: Candida albicans is a pathogenic yeast responsible for the fungal infection candidiasis. This fungus resides in the microflora of most of the population, in some cases entering into vulnerable areas of the body and overgrowing to cause worsened infection. With a 40% mortality rate of candidiasis, C. albicans' virulence has proven a severe threat to immunocompromised individuals. A gene, RBT1, in C. albicans' genome, encodes two secreted peptides that may be associated with Candida virulence. A mutation in RBT1 has been shown to block virulence. In order to determine whether RBT1 is a possible target for drug therapy, I've investigated whether peptides from RBT1 mediate Candida virulence. Zebrafish models are used in a range of studies to mimic human host-pathogen interactions. Injections into uninfected fish demonstrated that the Rbt1p-derived peptides are not toxic at up to a dose of 2 mg/ml. In C. albicans-infected fish, administering the peptides did not significantly alter fungal virulence, although preliminary results show a trend towards decreased virulence (up to 11.1%) when peptides are added to infection at the full concentration (2 mg/ml). Additionally, differences in CFU (colony-forming units) per fish between the Candida-infected and Candida with peptide groups suggest that Rbt1p-derived peptides may also lead to reduced fungal burden. This is promising evidence that the peptides may lessen candidiasis infection levels, which might occur through enhanced immune responses. Further research will involve administering these peptides to other RBT1 mutants to determine their effect on C. albicans strains of varying virulence levels.

1064. Neutrophil Expression is Linked to NFkB Pathway Genes

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Wyatt Cannell, Brandy-Lee Soos, Con Sullivan, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Neutrophils are immune cells which respond first to infection, where they migrate to the site of infection and then migrate away to resolve inflammation. Their inflammatory response must be sufficient to clear infection, but must also be carefully balanced as excessive inflammation causes tissue damage, such as that observed in severe respiratory infections like influenza virus. Our lab uses a zebrafish influenza A virus (IAV) infection model. Using a zebrafish mutant (Tg1(-8mpx:cxcr4b-EGFP)) with defective neutrophil migration, we found reduced survival after IAV infection. Analysis of RNA sequencing gene expression data from these mutants at 24 hours post IAV infection showed that the expression of several target genes in the NFκB inflammatory signaling pathway were altered. We hypothesize that dysregulation of this pathway in these mutants results in excessive inflammation. We have assayed the expression of candidate NFκB target genes using quantitative real-time PCR to validate the RNA sequencing data. Studies of NFκB signaling in these mutants will provide an understanding of inflammatory mechanisms of neutrophils that could be used to develop new therapies to regulate inflammation.

1065. Measuring the Enzymatic Activity of V. parahaemolyticus When Grown with Larvae of Black Soldier Fly (Hermetia illucens)

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Isaac Lambrecht, Matthew Moyet

Faculty Mentor: Edward Bernard

Abstract: Increasing global population has led to the adoption of new food sources for both animals and, inevitably, humans. One of these sources is Hermetia illucens, also known as the Black Soldier Fly (BSF). The larvae of BSF (BSFL) have shown promise as animal feed ingredients and are licensed for use in salmonids and poultry. However, the optimization of BSFL growth on organic waste substrates is hindered by pathogenic bacteria, such as Vibrio parahaemolyticus. When BSFL and V. parahaemolyticus are grown together, BSFL suffers significant weight loss. V. parahaemolyticus produces several enzymatic virulence factors including tdh, trh, and tlh. Tdh and trh are toxins that act as porins in the host cell membrane, creating an efflux of cations and an influx of water. Tlh is a notable molecular marker. The aim of this study was to determine if these virulence genes displayed increased expression when grown with BSFL, and if their expression correlates to the observed decrease in weight gain of larvae. RNA was extracted over the course of a 24-hour period from larvae inoculated with V. parahaemolyticus. Quantitative PCR was used to determine the expression levels of tdh, trh, and tlh genes in these samples. Remaining experiments and data analysis are ongoing.

1066. Interleukin-17 Receptor D Decreases Endothelial Activation and Leukocyte Infiltration but Does Not Affect Atherogenesis

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Shivangi Pande

Faculty Mentor: Igor Prudovsky

Abstract: Endothelial cell activation is one of the key driving mechanisms of disease pathophysiology of inflammatory diseases including crohn's disease, systemic lupus erythematosus, sepsis, cardiovascular disease and SARS-CoV2. However, the molecular mechanisms underlying endothelial cell activation remains poorly understood. Our studies focused on delineating the role of Interleukin-17 receptor D (IL17RD), an orphan receptor belonging to the Interleukin-17 signaling family, during endothelial cell activation. Our findings from these studies establish the upregulation of IL17RD driven expression of endothelial adhesion markers in human endothelial cells upon proinflammatory cytokine stimulation through the p38 MAPK pathway. Above further modulates endothelial cell function to promote the adhesion of primary monocytes. Our findings further characterized the role of IL17RD in regulating endothelial cell activation in vivo using an IL17RD global KO mouse model. Consistent with our in vitro findings, we found that IL17RD modulates the expression of aortic endothelial cell activation and promotes the infiltration of proinflammatory monocytes into the aorta under western diet induced inflammatory conditions in vivo. Next, in order to characterize disease relevance, we induced atherogenesis in IL17RD global and conditional knockout mouse models using a mutant gain of function AAV-PCSK9D374Y model of atherogenesis. Our results suggest that IL17RD does not significantly affect plaque size in vivo, however attenuates inflammation by modulating the levels of circulating cytokines.

1067. Investigating the Role of the Electron Transport Chain in the Determination of Lifespan in Caenorhabditis elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Timber Mattson, Seth Ashby

Faculty Mentor: Suzanne Angeli

Abstract: Mitochondrial activity is a determining factor in the aging process and the onset of several age-related diseases, such as Alzheimer's and Parkinson's disease. The electron transport chain (ETC) plays a key role in the movement of electrons to form energy in the mitochondria. Activation of beneficial stress responses such as the mitochondrial unfolded protein response (UPRmt) due to the loss of ETC subunits has been shown to lengthen lifespan and slow down age-related disease onset in the model organism Caenorhabditis elegans (1). However, to date, only a limited number of ETC subunits have been tested. In this study, we tested the role of subunits from F-ATP synthase, or complex V of the oxidative phosphorylation chain. This complex harnesses energy through a proton gradient to synthesize ATP, a highly versatile energy source, from ADP and inorganic phosphate (2). RNA interference (RNAi) was used to block the transcriptional expression of F-ATP synthase genes, and survival analysis was conducted to determine how the lifespan of C. elegans was affected. We blocked the expression of F-ATP synthase genes atp-1, atp-2, and atp-3, which correspond to human homologs ATP5F1A, ATP5F1B, and ATP5PO, respectively. We found that lowering the expression of the genes of interest increased the lifespan by about 53% (atp-1), 54% (atp-2), and 50% (atp-3), compared to controls. Consistent with previous findings, we find that loss of F-ATP synthase subunits leads to lifespan extension. Future research could involve quantifying the effects of these knockouts such as delayed development and decreased brood size.

1068. BMB210: Determining the Identity of Antibiotic Resistant Bacteria in Compost

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Nnamdi Baker, Lee Anderson, Tanner Hardison, Olivia Herman, Ryan McAulay, Sarah Morales

Faculty Mentor: Jennifer Newell-Caito

Abstract: All around the country, landfills are filling up with municipal waste of which the majority (60%) is organic materials including leaf and yard trimmings, manure, uneaten and spoiled food. Composting is a natural process of decomposition by bacteria and fungi of the organic materials in our waste and recycling it into a valuable fertilizer. It provides a way of reducing the amount of waste that needs to be disposed of and converting it to a product that is useful for gardening and other horticultural applications. The purpose of the BMB210 course is for students to identify antibiotic resistant bacteria from their group-designed compost experiments and to develop proficiency in several scientific laboratory techniques. Students designed their compost bioreactor experiments during the first week of class. Following a two-week incubation, students collected compost from the bioreactor and isolated the bacteria using serial dilution. Several diluents were spread on tryptic soy agar plates and incubated overnight. In order to test for antibiotic resistance, colonies were picked from the plates and streaked on new plates containing the antibiotics ampicillin, ciprofloxacin, gentamicin, and vancomycin. The zones of inhibition were measured and selected bacterial colonies were picked from the plates, inoculated in liquid media, and grown overnight in culture. A DNA miniprep kit was used to isolate DNA from the overnight bacterial culture. Primer for the 16S rDNA were used to amplify the bacterial DNA using PCR. Agarose gel electrophoresis was used to visualize the PCR products. DNA was purified from the gel and analyzed by PCR sequencing. NCBI Blast was able to identify the species of bacteria that was confirmed using biochemical testing.

1069. BMB210: Identification of Antibiotic-Resistant Bacteria in Compost Bioreactors

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Nnamdi Baker, Bella Butzgy, Mason Canon, Kaitlyn Doyle, Lily Gainer, Lyle Hansen, Griffin McDevitt, Karlene McMahon, Chase Quirion, Mary-Kate Smith,

Faculty Mentor: Jennifer Newell-Caito

Abstract: As the human population increases, so does the waste in landfills. This is a concerning problem across the country as organic materials encompass over 60% of the waste stream. Composting is a method where organic waste material is decomposed and recycled into fertilizer for soil. The microbiome that develops in compost mediates waste decomposition. The purpose of the BMB210 course is to identify bacterial species from the class's compost bioreactors and to develop student proficiency in scientific laboratory techniques. These techniques include, but are not limited to, performing serial dilutions, plate spreading, DNA extraction, chromatogram analysis, inhibition assays with antibiotics, measuring colony forming units, gel electrophoresis, and PCR reactions. To monitor and identify bacteria species that grew in the compost bioreactor, student's set-up bioreactors during the first week of the semester. After two weeks they isolated the bacteria from the bioreactor by performing serial dilutions and spreading the bacterial culture on tryptic soy agar plates. For inhibition assays, colonies were picked from the plates, inoculated in a saline solution, and then streaked on new plates containing the antibiotics vancomycin, ampicillin, gentamicin, and ciprofloxacin. After overnight incubation with the antibiotics, the resulting zones of inhibition for the bacteria were measured. Colonies were picked from the plates, inoculated in liquid media, and grown overnight. The DNA from the overnight bacterial culture was extracted using a DNA miniprep kit and the 16S rDNA was amplified using PCR. PCR products were visualized by agarose gel electrophoresis, the resulting band was purified, and sent out for PCR sequencing. The species of isolated bacteria was determined using NCBI Blast and verified using biochemical tests.

1070. Proteomic Differences in Perivascular Adipose Tissue During Cardiovascular Disease

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Caitlin Stieber, Christian Potts, Benjamin Tero, Young Sun Lee, Alli Roshni

Faculty Mentor: Lucy Liaw

Abstract: Cardiovascular disease is the leading cause of death in the world and is tightly linked to obesity. To study the intersection of these prevalent public health problems, we investigate perivascular adipose tissue (PVAT), which surrounds most vessels and exerts a paracrine effect on the underlying vascular smooth muscle. The focus of this study is to compare human PVAT from two groups of surgical patients – one undergoing mitral valve repair (VR) and one undergoing coronary artery bypass grafting (CABG). Previous work has shown demographic differences between VR and CABG groups, but no differences in adipose size, number, or stromal area in PVAT. To further understand what may be causing demographic differences, and to assess if there are molecular differences between groups, we evaluated the donor groups by proteomic analysis. We hypothesize that there will be molecular differences between VR and CABG PVAT and expect these differences to begin to account for demographic difference. PVAT was collected from donors undergoing VR and CABG surgeries, proteins isolated and analyzed with mass spectrometry, and multiple databases were used to analyze the proteomic signatures. Principle component analysis showed that VR PVAT and CABG PVAT samples were distinct. Additional analysis with STRING and PANTHER databases shows that protein differences between VR and CABG PVAT may be involved in signaling, adipogenesis, and fibrosis. We are currently working to assess these markers using immunocytochemistry, immunofluorescence, and immunoblot. Based on this preliminary data, it seems likely that expression of adipocyte, signaling, and fibrosis markers in PVAT correlate to disease state.

1071. Analyzing GBS Prophage Genomes

Submission Type: Exhibit

Submission Category: Biomedical Sciences

Author(s): Sydney Brown, Gavin Bressette, Sophie Charles, Katherine Southworth, Caitlin Wiafe-Kwakye, Melody Neely

Faculty Mentor: Melody Neely

Abstract: Group B Streptococcus (Streptococcus agalactiae) or GBS is a bacteria that commonly lives in the gastrointestinal and genital tract of people without causing any symptoms or harm. However, a mother colonized with GBS in her genital tract can infect the baby in utero or, during birth, resulting in serious, life-threatening disease. Normally antibiotics are administered to the pregnant mother during delivery or to the neonate after delivery to treat GBS infection. However, this can disrupt the natural flora of the baby, leading to possible long-term side effects including disruption of immune system development. Prophages are the viral genomes inserted into the chromosome of the bacteria and studying them can increase our knowledge about GBS and how to treat infections. Prophages are known to increase bacterial fitness, and in many cases, provide virulence genes that increase pathogenesis. However, little is known about the prophages that reside in GBS. Novel GBS prophages phiDMC1, phiDMC15, phiDMC33-2, and phiDMC34, were identified in the genomes of GBS clinical strains isolated from pregnant mothers. The prophage genomes were annotated using bioinformatic tools such as HHPRED, PECAAN, NCBI BLAST, and PhagesDB to identify protein-encoding genes . Multiple protein functions were identified that putatively could increase bacterial fitness including toxin/antitoxin systems, restriction modification systems and numerous membrane proteins. Studying these prophage genomes and the proteins they encode will deepen our understanding of how the phages provide genetic diversity and functional advantages to the host bacteria.

1072. Function and Activity of Brown Adipose Tissue (BAT) in Cardiac Arrest

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Carolina Cora, Breanna Morrill, Mary Sorcher, Joanne de Kay, Elena Chepurko, Vadim Chepurko, David Gagnon, Teresa May, Richard Riker, Sergey Ryzhov, David Seder

Faculty Mentor: Matthew Lynes

Abstract: Annually in the US, fewer than 10% of the 600,000 people who experience cardiac arrest (CA) survive, mainly due to the extensive brain injury resulting from disruption of systemic blood flow. Immediately following the reestablishment of circulation, glucose dysregulation can aggravate organ injury. Given the strong association between hyperglycemia and poor outcomes after CA, glycemic levels are closely monitored, but the mechanisms by which hyperglycemia exacerbates injury are incompletely understood. Brown adipose tissue (BAT) contributes to whole-body glucose homeostasis and can be activated by cold temperature to regulate body temperature by generating heat. Therapeutic hypothermia is routinely employed following CA to stimulate homeostatic mechanisms to maintain euthermia in response to the initial cooling. While hypothermic neuroprotection after ischemia-reperfusion is nearly uniformly successful in preclinical models, its efficacy in clinical practice remains unproven. We tested the hypothesis that CA alters BAT metabolism and function following cold exposure. One circulating biomarker for BAT is 12,13-diHOME, which is increased in animals exposed to cold temperatures. To investigate whether there are changes in circulating lipokines, such as 12,13-diHOME, we performed LC-MS-based targeted lipidomic profiling on serum from CA human patients both during and after treatment with therapeutic hypothermia. Principal component analysis showed a clear separation of the lipidomic profile 24 hours after CA for those patients who survived. These results suggest that higher levels of circulating 12,13-diHOME after CA are associated with lower mortality, and that the thermogenic response to therapeutic hypothermia may play a role in ameliorating the effect of cardiac arrest.

1073. Stop! Viral Infection in the Name of Drugs: Assessing JCPyV Infectivity After Treatment with Potential Inhibitors

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Noah Burby, Daisy Drinkert, Patrick Fleming, Sarah Foust, Audrie French, Kyle Murawski, Hector Orellana, Dorothy Smith, Katie Southworth, Sam Weafer, Lauren Cusson, Lucas Bennett

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) causes a benign kidney infection in 50-90% of the adult population. In immunocompromised individuals, JCPyV spreads to the central nervous system and destroys glial cells resulting in progressive multifocal leukoencephalopathy (PML). PML is a progressive disorder that causes severe neurological deficits and has a mortality rate of 30-50% in the first month of diagnosis. Treatments for PML are limited and can result in immune reconstruction inflammatory syndrome (IRIS), another fatal disease. Researchers in the Maginnis Lab at the University of Maine conducted a drug screen using the National Institutes of Health (NIH) Clinical Collection containing Food & Drug Administration (FDA)-approved drugs to determine possible inhibitors of JCPyV infection. The results showed that 117 drugs inhibited JCPyV infection, and 42 drugs were nontoxic at 10 uM concentration. Drug hits identified in the screen including targets of cellular receptors, transcription, DNA replication, and cellular metabolism were selected for further analysis. Glial cells were treated with inhibitors from the drug screen, and cellular toxicity was assessed using cell viability assays. Cells were then treated with non-toxic concentrations of inhibitors, and viral infectivity assays were performed to assess whether inhibitors would decrease infection by JCPyV. This research improves our understanding of JCPyV infection and could identify possible treatments for JCPyV by repurposing drugs that are already FDA approved.

1074. The Localization of Dystroglycan and Integrin Proteins Within Muscle Cell Membranes

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Mary Astumian, Komala Shivanna, Prakash Raut

Faculty Mentor: Clarissa Henry

Abstract: Muscular dystrophy and dystroglycanopathies are progressive diseases, varying in severity, affecting both muscle and neurological health. In the diseased state, muscles do not adhere correctly to the extracellular matrix (ECM) and fibers detach. In healthy muscle, the transmembrane proteins integrin and dystroglycan bind to ECM laminin protein. In zebrafish dystroglycan mutants and integrin mutants, laminin deposition and muscle health improved after oxidized nicotinamide adenine dinucleotide (NAD+) treatment. But in some dystroglycanopathy mutants, where dystroglycan is present but not correctly glycosylated, muscles health was not improved. To explain this, one hypothesis is that hypoglycosylated dystroglycan protein physically interferes with integrin clustering in the muscle membrane, preventing normal integrin-ECM binding activity. Therefore, the localization of dystroglycan and integrin proteins relative to each other at the muscle cell membrane is hypothesized to be important for muscle health. Dystroglycanopathy mutants that model human dystroglycanopathies are made. Using super resolution microscopy, the cluster size and average distance between the molecules of dystroglycan at the zebrafish myofiber membranes and myotendinous junction has been assessed. In the future, localization of integrin and dystroglycan in NAD+ treated mutants and untreated mutants and controls will be compared.

1075. Pain-Induced Neural Plasticity Following Neonatal Trauma: the Role of Neural Heterogeneity in the Central Amygdala

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Megan Tomasch

Faculty Mentor: Mike Burman

Abstract: Painful and traumatic experiences during development, such as time spent in the neonatal intensive care unit (NICU), have been shown to increase susceptibility to pain- and anxiety-disorders. Although the neurobiological mechanisms remain unclear, our lab has previously associated pain-vulnerability with alterations to cells expressing corticotropin releasing factor (CRF) in the central nucleus of the amygdala (CeA). The CeA is a hub of emotional responding and demonstrates both pro- and anti-nociceptive effects—possibly resulting from its heterogeneous populations of GABAergic neurons (i.e., cells that express CRF, SOM, DYN or PKC-delta all play different roles in pain). Assessment of neural heterogeneity within the CeA has not been explored developmentally, and current research fails to consider co-expression with multiple markers, including with CRF. We hypothesize that neonatal trauma alters the composition and function of these biomarker identifiable subpopulations within the CeA-CRF system, creating a pain-induced neural plasticity that primes the animal for altered pain responses and anxiety-like behaviors in later-life. Using fluorescent in situ hybridization (fISH), we visualized expression of CRF, SOM, and prodynorphin (DYN). Preliminary data identified populations co-expressing SOM+DYN, as well as populations expressing CRF alone, CRF+DYN and CRF+DYN+SOM. Investigation of changes to cellular properties (e.g., excitability) are assessed using electrophysiology and immunohistochemistry. Preliminary data confirm that CRF-expressing neurons in this area demonstrate at least three distinct firing phenotypes and membrane resting potentials. Further analyses will link these characteristics with specific biomarkers and how they are impacted by trauma/pain and development.

1076. Determining the Effect of F-ATP Synthase Calcium Binding on Lifespan in C. elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Arianna Hatt, Marcus Ratz

Faculty Mentor: Suzanne Angeli

Abstract: The mitochondrial permeability transition pore (mPTP) is a pathological channel that forms inside the inner mitochondrial membrane in response to excessive cytosolic $Ca2+$. Sustained opening of the mPTP leads to mitochondrial membrane rupture, release of $Ca2+$ into the cytosol, and eventual cell death. mPTP pathology increases with age- and age-related diseases such as heart disease, stroke, and neurodegeneration. F-ATP synthase (Complex V of the oxidative phosphorylation chain) is a major pore forming component. One of the subunits that comprises F-ATP synthase is β-subunit, or atp-2 in Caenorhabditis elegans. Published research has shown that point mutations introduced in a predicted calcium-binding motif of the β-subunit eliminate $Ca2+$ binding and also inhibit mPTP formation in bovine models. Our hypothesis is that the inhibition of $Ca2+$ binding sites in atp-2 will inhibit mPTP formation and lead to longevity in C. elegans. We will test the effects of altered atp-2 with C. elegans that have had a point mutation (T221S) introduced via CRISPR-Cas-9 to their calcium GVGKTV motif. We will monitor the survival of N2 (wildtype) and three different strains of the same point mutation T221S (ARM409, ARM410, ARM411). We expect to see increased lifespan of the mutant worms. Because mPTP pathology has been shown to increase with age- and age-related diseases, this study is important to find if there are ways to decrease these instances.

1077. Investigating Dendritic Spine Morphology as a Mediator of Cognitive Outcomes in Aged Diversity Outbred Mice

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Andrew Ouellette, Jeremy Herskowitz, Kelsey Greathouse, Audrey Weber, Niran Hadad

Faculty Mentor: Catherine Kaczorowski

Abstract: The intersection of genetic diversity, memory, and synaptic function is a critical component in better understanding age-related cognitive decline. Diversity Outbred mice offer the opportunity to investigate cognitive aging across a genetically diverse population in a controlled lab environment. DO mice exhibit an appreciable amount of variance in Contextual Fear Memory and Acquisition (CFM, CFA), which can be linked to individual differences in genetic background (Ouellette A. et al, 2022, Cell Reports). Here, we investigate the role of dendritic spines as a mediator of individual age-related changes in memory.

While there was not a decline in CFM or CFA between 8 and 18mo, we observed expectedly wide range in individual memory outcomes. Thin spine density significantly decreased between 8mo and 18mo, and stubby spine density increased. Spine volume across all spine types increased with age. Apical thin spine density explained 61% of the variance in CFM outcomes, while thin spine volume explained 79% and 43% of variance CFA in apical and basal dendrites respectively. Thin spine density, however, did not associate with CFA outcomes.

We have linked dendritic spine density and morphology as a potential mediator of individual outcomes across a genetically diverse population. Our results suggest that there may be an age-related conversion of thin to stubby spine types, and that mice with fewer thin spines are more likely to have better CFM outcomes, coinciding with reports of thin spines as dynamic “learning spines” rather than “memory storage” spines (Hayashi, Y. 2005, Neuron). We also show that the size of these “learning” thin spines may be more important memory acquisition than their total density.

1078. Regulation of Microtubule Dynamics During the Pheromone Response in Saccharomyces cerevisiae

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Loren Genrich

Faculty Mentor: Joshua Kelley

Abstract: The yeast Saccharomyces cerevisiae responds to pheromone through a G-protein coupled receptor (GPCR) signaling pathway. Upon receptor activation by pheromone, the heterotrimeric G-protein dissociates and initializes separate downstream signals through the Gα and Gβγ subunits. During this response, cells either elongate towards the pheromone source or form mating projections known as "shmoos." The kinesin Kar3 is located at the shmoo tip and regulates plus-end microtubule polymerization via interaction with Gα, which negatively regulates microtubule assembly. During pheromone-induced elongation, the nucleus aligns along the axis of cell polarity in a manner dependent on Gpa1 regulation of Kar3. Preliminary data shows that nuclear orientation during gradient tracking in hyperactive Gα mutants varies considerably over time, compared to wild-type. Therefore we hypothesized that microtubule dynamics contribute to normal gradient tracking through a Gα-dependent mechanism during the pheromone response. We are investigating cytoskeletal involvement in gradient tracking using yeast expressing N-GFP-Tubulin plasmid and the polar-cap protein Bem1-Ruby, which we will use to track microtubule localization and abundance during gradient tracking. We are also observing yeast that are expressing fluorescently labeled Kar3 during gradient tracking. We used a hyperactive Gα mutant that is unable to bind to the regulator of G-protein signaling (RGS), which prevents RGS-induced acceleration of the intrinsic GTPase activity of Gα, the primary negative regulator of G-protein signaling. Using live cell microscopy, microfluidics, and image analysis, I will test the hypotheses that Gα control of Kar3 is important for polarized growth and that microtubules contribute to gradient tracking through a Gα-dependent mechanism.

1079. Effect of Prophages on Mycobacterial Survival in Macrophages

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Katelyn Amero, Sarah McCallister, Caitlin Wiafe-Kwakye

Faculty Mentor: Sally Molloy

Abstract: Mycobacterium abscessus is an increasing global health threat that is often multi-drug or totally drug-resistant with a treatment success rate of 45%. It is one of the most antibiotic-resistant non-tuberculosis mycobacteria (NTM), which are now isolated more than M. tuberculosis in the U.S. and Canada. Integrated bacteriophage genomes called prophages increase mycobacterial antibiotic resistance and virulence, as well as the expression of intrinsic antibiotic resistance genes. Strains of M. chelonae, a closely related NTM, that carry two prophages called McProf and BPs experience a significant increase in whiB7 expression, which is a mycobacterial transcriptional regulator for a large set of intrinsic antibiotic resistance genes. These genes include drug efflux pumps and acetyltransferases such as eis (enhanced intracellular survival), which acetylates and inactivates aminoglycosides. Eis acetyltransferases also acetylate macrophage histones and impact their gene expression, suppressing autophagy, inflammatory responses, and bacterial killing with reactive oxygen species. M. chelonae carrying prophages McProf and BPs experiences a 10-fold increase in eis2 expression, suggesting that the bacteria will have enhanced intracellular survival. We hypothesize that increased expression of whiB7 and its target gene eis2 in M. chelonae strains carrying both McProf and BPs prophages will increase survivability during macrophage infection when compared to strains carrying only one (McProf or BPs) or no prophages. Infection and survivability assays have been optimized using M. chelonae and RAW264.7 murine macrophage cells. Upcoming experiments will determine the impact of these prophages on mycobacterial survival inside macrophages.

1080. Double-Edged Sword: Increased Survival in IAV Infected mpx Knockout Zebrafish Potentially Related to Differential Expression of Hydrogen Peroxide Genes

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Dominic Needham, Emily Fraser, Eleanor Carrolton, Keith Hutchison, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza A virus (IAV) poses a serious threat to human health through yearly flu epidemics. IAV was responsible for the 1918 flu pandemic, resulting in at least 50 million deaths worldwide. The pandemic disproportionately affected young, healthy individuals, possibly by producing an overactive innate immune system response. Myeloperoxidase (MPO) plays an important role in the innate immune system neutrophil response by producing the reactive oxygen species hypochlorous acid, which destroys pathogens but can also lead to tissue damage in the host. Zebrafish embryos and larvae are an ideal model for the innate immune system, as adaptive immunity does not develop until approximately four weeks post fertilization. A zebrafish knockout strain of mpx (the zebrafish ortholog of MPO) was studied to better understand MPO's double-edged sword effect. IAV-infected mpx-knockout zebrafish had increased survival rates compared to wild-type. RNA-Seq analysis of gene expression at different timepoints of infection revealed differential regulation of many genes. Hemoglobin alpha embryonic 5 (hbae5), involved in the hydrogen peroxide metabolic process, was found to be significantly upregulated. Nuclear receptor subfamily 1 group d member 1 (nr1d1) is involved in circadian regulation of gene expression and was found to be downregulated. These genes may be differentially regulated as a result of increased hydrogen peroxide concentration in host tissue. Further analysis of these genes may reveal why suppressing MPO immune response results in decreased mortality in IAV infection, and explain how an overactive immune system might result in harm to the host.

1081. Ensuring Reproducibility of Experimental Results Through Proper Imaging Methods

Submission Type: Exhibit

Submission Category: Biomedical Sciences

Author(s): Matthew Sarapas, Samara Obenauer, Felix Morrissey, Ian Harden

Faculty Mentor: Karissa Tilbury

Abstract: One of the most pressing issues facing the scientific community today is difficulty in reproducing the results of experiments, a situation commonly referred to as the Replication Crisis. A significant roadblock to reproducibility in biology is failure to standardize and report methods in imaging and image processing. Many papers in the field of biology scarcely mention imaging procedures when discussing methods, leaving specifics of how images were obtained up to speculation for someone wishing to reproduce the experiment. A study by Guillermo Marques reports that on average, only 138 words, or 7% of the “materials and methods” section of papers featuring original microscopy images are dedicated to image acquisition. The objective of our project is to provide a resource on how to standardize their image acquisition and processing, and properly report it. Topics will include the selection of imaging instrumentation, proper usage of a microscope, how a microscope forms an image, and best practices in digital image processing. Using and creating reproducible images will allow researchers to more accurately compare quantitative data obtained through microscopy and confirm scientific findings. Image processing software, such as FIJI can create code that could be used by another person to ensure that the same image analysis parameters are used when attempting to reproduce the results of an experiment, or conduct a similar experiment. Microscopy is fundamental to biomedical research, and proper training in imaging and reporting practices can help to ensure that the results obtained using this ubiquitous tool are consistently reproducible by other researchers.

1082. Interactions Between Streptococcus agalactiae and Candida albicans Affect Persistence and Virulence

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Kathryn Patenaude, Anna Lane, Marc St. Pierre, Robert Wheeler

Faculty Mentor: Melody Neely

Abstract: Treatment of opportunistic infections can be problematic because of a lack of understanding of how other organisms found in the localized environment play a role in the progression of infection. One factor that has been poorly studied is how bacteria and fungi interact together in the host, and how that may be influencing virulence. Both the fungus Candida albicans (C.a.) and the bacteria Streptococcus agalactiae (Group B Strep or GBS) are commensals that colonize the vaginal tract. While usually harmless in the human host, both organisms can cause opportunistic infections in immunocompromised patients, which can also progress to co-infections. What we don't understand is how interactions between these organisms can affect the progression of infections caused by each pathogen or how they affect treatment outcomes. Previous in vitro work has analyzed interactions between other commensal bacteria and C.a., but there is not much known about how GBS and C.a. interact in co-infections and what influence that interaction may have on the effectiveness of current treatments. Research to date has revealed that C.a. can increase growth of GBS in vitro in nutrient poor media, even in the presence of antibiotics. Increased virulence during a co-infection in zebrafish larvae is observed suggesting a synergistic effect in vivo. Fluorescent microscopy also reveals increased growth and survival of C.a. in vivo during a coinfection compared to a solo infection. These data are highly relevant to treatment of human infections caused by these organisms as they are often found co-colonizing the same tissue environment.

1083. Establishing Rab27a as a Regulator of Vascular Reactivity

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ashley Soucy, Anne Harrington, Larisa Ryzhova, Abigail Kaija, Benjamin Tero, Christian Potts

Faculty Mentor: Lucy Liaw

Abstract: Cardiovascular disease (CVD) is a leading cause of mortality, and it is imperative to understand the mechanisms driving disease establishment and progression. Adipose derived signaling factors, such as exosomes, impact metabolic diseases. However, very little is known about the importance of perivascular adipose tissue (PVAT)-derived exosomes in CVD. Defining the role of PVAT-derived exosomes in regulating cardiovascular physiology may help identify novel therapeutic targets that could help reduce CVD mortalities. According to the Common Metabolic Diseases Knowledge Portal, rare RAB27A variants are associated with changes in BMI and glucose sensitivity. RAB27A is an endosomal trafficking protein that regulates exosome secretion by promoting the fusion of the endosomal compartment to the plasma membrane. With this work, we present a novel mouse strain for studying the importance of global Rab27a expression. These studies are foundational in establishing a connection between Rab27a and vascular reactivity in male and female mice. A proteomic study further supported these results by showing that the proteomic signatures of male Rab27a null PVAT and aorta were enriched for proteins associated with cardiovascular and metabolic phenotypes. We predict that these changes in reactivity are the result of dysregulated exosome signaling due to changes in proteomic cargo. Future studies will need to focus on determining the mechanisms driving the sex-dependent responses to global loss of Rab27a, and whether targeted loss of Rab27a in the PVAT or also results in altered thoracic aorta physiology.

1084. Prioritization of Non-Coding Cancer Drivers using MPRA

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): John Butts, Rodrigo Castro, Sagar Gosai, Steve Reilly

Faculty Mentor: Ryan Tewhey

Abstract: As cells age, somatic mutations accumulate through several means including cigarette smoke, UV damage, and DNA replication errors. These mutations are predominantly benign, "passenger mutations", however when mutations confer selective advantages they are known as "drivers" and contribute to tumorigenesis. Given the high background of passenger mutations, often thousands per driver, the prioritization of drivers for validation is challenging. Studies of driver mutations have largely focused on coding sequences, where the impact of a mutation is readily assigned. Advancements in whole-genome sequencing (WGS) have expanded the search for drivers to the non-coding genome but this comes with significant challenges. Unlike coding mutations, the impacts of non-coding mutations are often obscure. For example, if a mutation lies in a cis-regulatory element (CRE) one must determine the gene it regulates and even then, gene expression changes may be small between alleles and operate through cryptic mechanisms. Massively Parallel Reporter Assays (MPRA) allow researchers to test thousands of sequences for their regulatory potential and are sensitive enough to quantify the impact of single nucleotide changes. Our group has generated a model from dozens of MPRA experiments, testing hundreds of thousands of sequences, capable of predicting MPRA activity with high accuracy. Using this model we generated predictions for all WGS derived non-coding mutations in the Catalog of Somatic Mutations in Cancer (COSMIC) and find enrichments for active elements in promoters, enrichment of expression modulating variants in recurrent promoter mutations and more highlighting the power of reporter assay models to prioritize non-coding cancer drivers in-silico.

1085. Effect of D93 Antibody on Cellular Migration in a Breast Cancer Cell 3D Spheroid Model Embedded in a Collagen Gel

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Zoe Vittum, Jordan Miner

Faculty Mentor: Karissa Tilbury

Abstract: Two-dimensional (2D) monolayer cancer models are commonly used for invasion and tumor progression assays. However, 2D models pose limitations as they poorly replicate the cell-to-cell and cell-extracellular matrix interactions of biological systems . Due to this, previous publications have noted significant differences in migratory and invasion patterns between 2D and in vivo models. 3D spheroid models are popular as they have been shown to reflect in-vivo tumor models and allow for modeling of the extracellular matrix (ECM), more accurately reflecting the biological system. The extracellular matrix is primarily composed of collagen which provides support and influences the behavior of the tumor cells by regulating adhesion, migration, invasion, and other processes. D93, a collagen specific antibody, has been shown to have varying and conflicting effects on cellular migration and inhibiting tumor growth in early preclinical trials and 2D models. Here 3D MDA-MB-231 breast cancer cell spheroids were embedded in collagen gels with D93 humanized antibody (20 μg/mL in PBS) and without D93 (only PBS). For the validation trail, brightfield images taken at 0 and 24 hours to quantify cellular migration. After 72 hours, the spheroids and collagen matrix were stained for D93 and DAPI to further localize cells and visualize cellular interactions with the surrounding collagen matrix. At 24 hours it was found that the D93 group displayed increased cellular migration over the control. Due to the unexpected results found in the feasibility trials, further assays will be conducted with an IgG isotype control antibody and younger spheroids for more controlled results.

1086. Improving Cancer Patient Access to Precision Medicines Using Molecular Diagnostics

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Michael Babcock, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Cancer is the leading cause of death in Maine. Emerging personalized medical treatments require reliable biomarker testing results performed by molecular (DNA and RNA) diagnostic profiling. Maximizing tissue availability is essential for cancer diagnosis, molecular profiling, and treatment development. Insufficient formalin-fixed, paraffin-embedded (FFPE) tumor material is the most common preanalytical factor resulting in molecular profiling failure and limiting patient access to precision medical treatments. For instance, approximately 30% of tumor biopsies from advanced lung cancer patients are insufficient for molecular subtyping due to limited tissue. This material is typically provided after the tissue has been sectioned for all diagnostic tests required to determine a cancer diagnosis potentially resulting in an inadequate amount of FFPE tissue available for further studies. Adequate tumor cellularity (30% content in approximately 25 mm2) and input quantity of nucleic acid (DNA and/or RNA) are the two most common factors associated with the ability to produce quality next generation sequencing (NGS) results. In this study, discarded tissue sections from histopathology processing of patient tumor material for cancer diagnosis were used as a specimen source to provide adequate material for molecular profiling studies. Hematoxylin/eosin stained tissue sections from de-identified cancer patient biopsies and excisional samples demonstrate tissue section size limitations. Mutational findings are presented to show minimal tumor content (in % cellularity) requirements. Pathogenic translocations and mutational results found in melt-curve and NGS assays were compared to those from a commercial clinical laboratory. The ability to reliably test samples improves Maine cancer patient access to precision medicine.

1087. Characterization of Total Polyphenolic Content of Natural Remedies used by Indigenous People

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Kyle Murawski

Faculty Mentor: Jennifer Newell-Caito

Abstract: Polyphenols are secondary metabolites that are found within many plants. The importance of polyphenols is that they act biologically as antioxidant compounds that can help protect against oxidative stress. Several human diseases can be attributed to oxidative stress, ranging from cancer to neurological disorders. People Indigenous to North America use a wide variety of plants in medicinal practices. Those plants that were traditionally used in teas may have polyphenols contributing to the observed medicinal benefit. The purpose of this research is to create and determine the polyphenolic content of extracts of cedar bark, yarrow flowers, sage leaves, and mint leaves: plants that were all used in medicinal tea by Indigenous people. This research will help gauge the antioxidant effects of these plant extracts. In order to determine the polyphenolic content of these plants, the polyphenols were extracted from the plant tissue using a 1:1 mixture of acetone and water. These extracts were then distilled to remove the acetone. The resultant plant extracts were made in triplicate in order to form a reliable average polyphenolic concentration. The polyphenolic content of the plant extracts was quantified using gallic acid as a standard in the Lowry assay. These extracts have the potential to treat a number of diseases that are caused by oxidative stress including Parkinson's Disease and Alzheimer's disease. In the future these extracts will be evaluated for their antioxidative properties when used as a pre-treatment in oxidant exposed nematode worms, specifically, the model organism Caenorhabditis elegans.

1088. Probing the Role of Serotonin receptors in the JC Polyomavirus Infectious Cycle

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Lucas Bennett, David Winski, Samuel Hess, Melissa Maginnis

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) is a ubiquitous human pathogen that infects 50-80% of the human population, persisting as an asymptomatic infection in the kidneys. In immunocompromised individuals, JCPyV can migrate to the brain, causing a debilitating demyelinating disease known as progressive multifocal leukoencephalopathy (PML). During infection, viruses utilize a specific subset of receptors on the cell surface to hijack normal cell processes and enter the host cell. JCPyV requires the serotonin (5-hydroxytryptamine) subtype-2 receptors (5-HT2R), to mediate entry and infection of host cells. All three 5-HT2R subtypes, 5-HT2AR, 5-HT2BR, and 5-HT2CR, support JCPyV infection. JCPyV localizes with 5-HT2Rs during entry and induces receptor clustering, which likely drives viral endocytosis. However, the contribution of each 5-HT2R subtype during viral entry and cellular signaling remains unknown. We have probed the role of 5-HT2Rs in infection from two distinct angles. We tested the effects of activation and inhibition of these receptors by applying specific 5-HT2R agonists and antagonists during viral entry. We also tested whether 5-HT2Rs activate downstream signaling during infection by probing the activation of the mitogen-activated protein kinase pathway during the initial phase of infection. Understanding how these receptors support both entry and priming the cellular machinery for viral infection are key to defining potential cellular targets for treatments to prevent PML.

1089. Development of a Novel Luciferase Assay for Quantifying Viral Burden in Order to Evaluate Drug Efficacy in Zebrafish

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Samuel Weafer, Brandy-Lee Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Every year in the United States, Influenza A, one of four Influenza serotypes, is responsible for tens of millions of respiratory infections. Some of these cases lead to severe illness, which can result in hospitalization and death. We use a zebrafish model to study influenza A virus (IAV) infection. When zebrafish, which share similar genes and immune cell types with humans, are infected with IAV, a hyper-inflammatory response can be observed like what is seen in severe human infections. Neutrophils, which are the first immune cells to respond to infection, produce a large amount of reactive oxygen species, (ROS). ROS are powerful oxidizers that can help clear infection, but excessive ROS production can damage tissues non-specifically. Previous studies of IAV-infected zebrafish have shown severe damage to skeletal muscle tissue. We hypothesize that balancing the generation of ROS by neutrophils will optimize viral clearance while limiting tissue damage. Our laboratory recently found a small molecule drug that inhibits NOX2, part of the complex responsible for producing ROS, reduces tissue damage in zebrafish. We are currently determining whether viral burden in drug treated zebrafish using tissue culture infectious dose (TCID50) assays. However, the TCID50 assay is semi-subjective and we are developing a new luciferase assay to precisely quantify MDCK cell viability with a plate reader in order to quantify drug efficacy.

1090. Generation of Two Mechanistically Distinct Transgenic In Vivo Axolotl Cell-Ablation Systems at Various Developmental Stages

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Gabriela Johnson

Faculty Mentor: James Godwin

Abstract: Unlike humans, salamanders have a high regenerative capacity that enables them to undergo scar-free wound repair and functionally replace a range of clinically relevant adult structures following injury, including parts of the brain, heart, spinal cord, and limbs. The axolotl is a type of salamander that is supported by a growing catalog of tissue and cell-specific transgenic lines where the translucent skin facilitates high quality imaging and cell tracking. The ability to assign function to specific cell types in regeneration has been obstructed by the lack of effective cell-specific ablation systems. To solve this problem, we developed two independent transgenic cell-ablation platforms in parallel that genetically sensitize target cells to drug induced cell death in vivo. The metronidazole prodrug-inducible enhanced-nitroreductase enzyme system (NTR 2.0) and the small molecule-inducible Caspase 9 (ihCasp9) ablation systems were compared in transgenic axolotls to evaluate ablation efficiency in different stages of axolotl development. Drug concentrations capable of effectively inducing death in genetically sensitized cells were determined in vitro. In vivo grafting studies were used to optimize drug dose, carrier vehicle, route of administration, and ablation kinetics. These robust genetic systems are the first to be implemented in axolotl and provide researchers with the tools required to conduct detailed studies aimed at understanding cell-specific functions during regenerative or developmental processes in vivo. Investigating the cellular mechanisms required for scar-free wound repair can provide insights for improving the regenerative capabilities of humans.

1091. Group B Streptococcus Prophage Accessory Protein Effects on Bacterial Fitness and Virulence

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Hannah Maurais, Caitlin Wiafe-Kwakye

Faculty Mentor: Melody Neely

Abstract: Bacteriophages are viruses that infect bacteria. When introduced into the cell, they can insert their DNA into the host cell's genome and become prophages. Prophages have been found in Streptococcus agalactiae (Group B Streptococcus or GBS), a human pathogen that colonizes the vaginal tract of 25% of pregnant women, and can cause life threatening illnesses in infants such as sepsis or meningitis. Prophages often contribute to bacterial virulence and fitness through the accessory proteins they carry, but it is currently not known what specifically is in GBS prophages that is contributing to GBS virulence. An accessory protein of interest, called Paratox, has been found in the majority of GBS prophages and has contributed to natural competence in other species of Streptococcus, however, we currently have no information on what Paratox is doing in GBS. The gene adjacent to Paratox and transcribed in the opposite direction encodes a protein called the Holin-like toxin that may influence Paratox function and expression. A third GBS prophage gene of interest, gp32, putatively carries a Toll/interleukin-1 receptor (TIR) domain that may be used to interact with human immune cells. In this project, we will determine the conditions in which Paratox is expressed and how it affects bacterial fitness or virulence. We will also analyze virulence in a phage cured strain that has been cloned with gp32. The results from this study will provide new information on how prophage genes can contribute to overall virulence and bacterial survival.

1092. Antimicrobial Agent Cetylpyridinium Chloride Exposure in Rodent and Primary Human Cells: Mechanisms of Mitochondrial Toxicity Revealed via Novel Toxicological Methods

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Emily Ledue, Sasha R. Weller, John E. Burnell, Bright Obeng, Brandon M. Aho, Tetiana Systuk, Juyong K Shim, Samuel Hess

Faculty Mentor: Julie Gosse

Abstract: Antimicrobial agent cetylpyridinium chloride (CPC) is added to consumer products such as mouthwash, poultry, and pharmaceuticals through which human exposure occurs. Previously described as an inert ingredient, CPC hasn't been sufficiently studied for effects in eukaryotes. Despite the dearth of information, three publications suggest CPC is a mitochondrial toxicant; a claim our data bolsters. Mitochondrial toxicity is linked to health ailments including two top-ten leading causes of death in the United States: Alzheimer's and cardiac disease.

Our study uses novel techniques to show low-micromolar CPC induces mitotoxicity in multiple cell types. Super-resolution microscopy by fluorescence photoactivation localization was used to visualize the effects of CPC on mitochondrial nanostructure in live cells demonstrating donut-like structures, a hallmark of mitochondrial toxicity.

In galactose media, cells are forced to produce ATP via mitochondria. Exploiting this, we found CPC inhibits ATP production in rat RBL-2H3 immune cells, mouse NIH-3T3 fibroblasts, and primary human keratinocytes. To contextualize the potency, ATP inhibition by CPC (EC50 1.7 μM) approaches that of canonical mitotoxicant CCCP (EC50 1.2 μM). Similarly, oxygen consumption rate (OCR) is halved by CPC in RBL-2H3 cells (1.75 μM) and primary human keratinocytes (1.25 μM).

Ongoing efforts work to elucidate mechanisms of CPC mitotoxicity using an assay novel to toxicology. Colorimetric dye reduction represents electron flow through mitochondrial respiration. Preliminary results suggest inhibition of complex I (NADH dehydrogenase); a theory suggested by two previous studies. Continued research aims to comprehensively describe the mechanism of CPC mitotoxicity as we continue to reveal health hazards in over-the-counter products.

1093. Uncovering Components of Pseudomonas aeruginosa Supernatant that Enhance Antifungal Drug Efficacy Against Candida albicans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Desiree Tanner, Kamri Sharp, Siham Hattab

Faculty Mentor: Robert Wheeler

Abstract: Candida albicans is the most prevalent causative agent for fungal infections, ranging from mild to life-threatening. It is a commensal pathogenic yeast found in the human microbiome that becomes a health issue in immunocompromised patients. Cystic fibrosis (CF) patients are frequently infected with C. albicans and other fungal and bacterial populations, carrying higher numbers than healthy individuals. P. aeruginosa is also a frequent microbial resident in those with CF. The antifungal drug Fluconazole (FLC) is used in cases of severe fungal or yeast infections. However, with the nuisance of antimicrobial resistance, medicines like FLC are not as successful in eradicating the infection. Recently, it was discovered that C. albicans is more susceptible to the effects of FLC when grown with the supernatant of P. aeruginosa. The goal of this research was to determine if protein components in the supernatant are responsible for this enhanced drug action of FLC. 24- and 48-hour CFU (colony forming unit) spot assays were performed to look at the effect of treated P. aeruginosa supernatant to determine if the biochemical component responsible can be heat-inactivated. Proteinase K was also used to determine if the biochemical component is a protein. Results show that the active component in P. aeruginosa supernatant cannot be inactivated by heat or degraded by proteinase K. Identifying the active component in the supernatant will allow the development of a novel antifungal drug therapy, which can be applied to severe fungal infections.

1094. Cell-type Specific Mechanisms of JC polyomavirus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sophie Craig, Michael P. Wilczek, Aiden M. C. Pike, Benjamin L. King

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) is a ubiquitous human pathogen that infects kidney and brain cells. In most people the virus will go unnoticed as a lifelong, asymptomatic infection of the kidney; in certain severely immunocompromised individuals, the virus can traffic to the brain and cause a lytic infection of glial cells. This destruction of glial cells leads to the development of a neurodegenerative disease called progressive multifocal leukoencephalopathy (PML), a debilitating and often fatal infection for which there is no cure or approved treatment. JCPyV is highly species- and tissue-specific, limiting models with which it can be studied. Primary cells provide an accurate in vitro model with which to study JCPyV and are a novel tool to study JCPyV entry and infection. JCPyV has a double-stranded DNA genome with a hypervariable noncoding control region (NCCR) that contains transcription factor binding sites (TFBS) and is rearranged based on the disease state of the patient and the type of infected tissue from which the virus was isolated. NCCR rearrangement is associated with PML, and an analysis of JCPyV sequences identified potentially novel TFBS that are associated with JCPyV infection of specific tissues. Through RNA sequencing of primary cells infected with JCPyV NCCR variants followed by differential gene expression analysis, the cell- and JCPyV variant-specific mechanisms of JCPyV infection will provide insight into JCPyV tissue tropism and pathogenesis. Ultimately, this work will help uncover antiviral targets to reduce the spread of JCPyV and the impact of PML.

1095. Role of Pattern Recognition Receptor Signaling in Immunity Against C. albicans Infection in Zebrafish

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Gursimran Dhillon, Linda Archambault

Faculty Mentor: Robert Wheeler

Abstract: Candidemia carries a 40% mortality risk and results in billions in annual healthcare costs. One potential new therapeutic avenue is immunotherapy, but this will require unveiling how our immune system recognizes and responds to Candida albicans. C. albicans is recognized by Toll-like and C-type lectin receptors (TLRs and CLRs), but temporal and spatial patterns of immune activation and fungal clearance are yet to be ascertained at high resolution. I am seeking to define how TLR and CLR signaling regulate the immune response toward Candida infection, leveraging intravital imaging of host and fungal cells in the transparent zebrafish. I am taking advantage of the fact that adapter protein MyD88 is utilized by most TLRs, whereas CLRs utilize CARD9, so inactivation of each will reveal how the whole class of receptors functions. C. albicans infections in mutant zebrafish (missing functional MyD88 and/or CARD9) have been intravitally imaged and analyzed for fungal pathogenesis and immune activation. Our preliminary data points to an unexpected difference between myd88-/- and wildtype zebrafish immunity: myd88-/- fish survive at higher rates. We also find that NF-kB pathway activation and TNFa expression is not dependent on MyD88. We will be quantifying the overall gene expression of a large panel of immune genes by quantitative PCR. Combining this with longitudinal imaging and survival experiments will hopefully reveal how these pathways affect early immune responses and provide effective immunity (or not) to fungal infection, and this data will hopefully help in the development of immune therapies targeted to fungal infections.

1096. Comparison of MicroRNAs Between Ecologically Divergent Sparrow Species

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Kayla Barton, Adrienne Kovach, Brian Olsen, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Our long term goal is to understand the evolution of genomic architecture in adaptation to environmental stressors. The ability to maintain cellular homeostasis under a spectrum of stressors is critical to survival. Tidal marsh sparrow species have adapted to live in a harsh high salt environment relative to inland species. We are studying multiple sparrow species in tidal marsh, generalist, and inland environments to determine which genes and pathways are under selection in tidal marsh populations using comparative genomics, population genomics, and transcriptomics. MicroRNAs (miRNAs) are small non-coding RNAs that regulate gene expression of target genes. The set of miRNAs in animals is proportional to organismal complexity. As such, they can be used as characters to study evolution. Prior studies have examined the differences in miRNAs between broad ranges of taxa. We aim to determine whether the sets of miRNAs differ among a group of closely related species, allowing us to better understand the contemporary evolution of these species. Using twelve opportunistically sampled Nelsons, Saltmarsh, Savannah, and hybrid Nelsons/Saltmarsh sparrow chicks we developed protocols for whole chick RNA extractions, sequenced small RNA, annotated miRNAs, and compared miRNAs between species. To our knowledge, this would be the first study to examine the evolution of miRNAs among these species.

1097. Polymicrobial Interactions Affect Anti-fungal Treatment Efficacy

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Siham Hattab

Faculty Mentor: Robert Wheeler

Abstract: Microbial communities interact in multiple ways during infection which can affect nutrients availability and response to antimicrobial drugs. Candida albicans is an opportunistic fungus that causes invasive candidiasis with 40 % mortality in hospitals. Pseudomonas aeruginosa is the most important pathogen responsible for respiratory tract infections in cystic fibrosis patients. Coinfection with both pathogens is associated with poor prognosis and decreased lung function. Nevertheless, it is not well understood how these two pathogens interact in the lungs or how treatment efficacy is altered by these interactions. Fluconazole (FLC) is a widely used anti-fungal treatment against C. albicans infection, but tolerance to FLC is linked to treatment failure in clinics. We investigated the efficacy of anti-fungal treatment during C. albicans-P. aeruginosa co-infection and found that P. aeruginosa synergizes with FLC both in vitro and in a swimbladder zebrafish infection model. The swimbladder model is a powerful tool that mimics human lung and allows intravital imaging to visualize microbial growth and immune cell response. Increased FLC efficacy was linked partially to iron sequestration caused by P. aeruginosa and decreased tolerance to FLC. This work will help us gain new insights into how complex microbial interactions make fungi more susceptible to antimicrobials and identify future therapeutic targets to decrease C. albicans tolerance to FLC and thus increase treatment efficacy.

1098. The Role of Diabetes Mellitus During Co-infections of Streptococcus agalactiae and Candida albicans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Logan Christian

Faculty Mentor: Melody Neely

Abstract: Diabetes mellitus has become a growing epidemic in the United States as 37.3 million people have been diagnosed with diabetes as of January 2022. Of pregnant mothers, 2-10% develop gestational diabetes due to hormonal changes that lead to insulin resistance. Streptococcus agalactiae (GBS), a Gram-positive bacterium, and Candida albicans (CA), a polymorphic fungus, are found in a commensalistic relationship in the vaginal tract. Diabetes was found to have an increased association with risk of invasive GBS infection in non-pregnant populations and hyperglycemic environments provide CA with excess of its main energy source, glucose. We hypothesize that CA protects GBS growth in the presence of environmental stressors such as excess glucose or antibiotics. Analyses were conducted in vitro (co-cultured glucose/antibiotic assays, growth curves, and fluorescent microscopy) and in vivo (zebrafish survival assays and utilization of a hyperglycemic zebrafish model). Preliminary data suggests that GBS growth recovered with CA in a glucose-rich environment. The Neely Lab showed that co-cultured Ca and GBS produce increased growth of GBS in excess glucose and a reduction in antibiotic efficacy. Systemic infection indicates that the rate of zebrafish survival decreased in solo infections between GBS and GBS + excess glucose. The presence of GBS and CA grown in excess glucose showed a decreased rate of zebrafish survival compared to a co-infection of GBS and CA without excess glucose. Increased GBS growth and decreased rates of zebrafish survival may be attributed to interactions between these two organisms from a dual infection in presence of excess glucose.

1099. ColorFlu Zebrafish: An In Vivo Fluorescent Influenza A Virus Infection Model

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Brandy-Lee Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza virus infection can cause severe respiratory disease and is estimated to cause 9-41 million illnesses annually in the US. Our research aims to understand how the innate immune system responds to influenza virus infection to inform the development of new therapies. Zebrafish embryos are powerful models to study innate immunity in response to influenza A virus (IAV) infection since adaptive immunity is not fully functional until several weeks post fertilization. While the function of immune cells can be studied in vivo using fluorescent reporter lines, a significant limitation is the ability to visualize the virus. To overcome this, we developed new methods to study IAV infection in zebrafish by using four distinct fluorescent IAV strains, called ColorFlu, originally developed for mice by the Kawaoka lab. Using our ColorFlu zebrafish infection model, we monitor IAV infections and subsequent innate immune response in real-time. We have used this model to study how neutrophils generate and release reactive oxygen species (ROS) while responding to infection. ROS degrades pathogens directly through oxidative damage. However, ROS dysregulation can lead to hyperinflammation causing tissue damage and death. We hypothesize that the regulation of neutrophil ROS production is mediated by gene networks composed of coding and noncoding genes. To investigate our hypothesis, we study how genetic and pharmacological inhibitors of ROS alter survival, viral burden, and neutrophil migration using ColorFlu. The ColorFlu zebrafish model of IAV infection is a powerful new tool to visualize the impact of genetic and drug therapeutic interventions for IAV infections.

1100. Novel Mycobacterial Prophage Genomes and Their Polymorphic Toxin Immunity Systems: A Tail of Tandem Prophages

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Eleanor Carrolton, Alison Kueck, Dorian Royal

Faculty Mentor: Sally Molloy

Abstract: Nontuberculous mycobacterial infections (NTM) have increased in healthy and immunocompromised North Americans, and are a major health risk due to extensive and sometimes total antibiotic resistance. Most NTM strains, including Mycobacterium abscessus and M. chelonae, carry prophage in the bacterial genome, hypothesized to contribute to bacterial virulence. Whole genome sequencing was performed on genomes from M. chelonae and M. salmoniphilum isolates from diseased fish. Eight novel prophages were identified, sorted into Mab clusters, and characterized to understand how prophages impact bacterial virulence. The prophages prophiMSKB2-1 (Singleton), prophiMSKB2-2 (Mab E), prophiMSKB2-3 (Mab K), and prophiMSKB2-4 (Mab N) were identified in the M. salmoniphilum genome. Prophages prophiMCKB1-1(Mab F), prophiMCKB1-2 (Mab N), prophiMCKB1-3 (Mab K), and prophiMCKB1-4 (Mab I) were identified in the M. chelonae isolate. The prophage genomes defined by attachment sites (attL and attR), are 49,969-72,955 bp in length and encode 71-116 genes. Two of the prophages, prophiMSKB2-3 and prophiMSKB2-4, are in tandem in the M. salmoniphilum genome, appearing to share an attachment site. The genomes are enriched in genes that may impact host virulence; toxin-antitoxin systems and Esx secreted toxin systems (Polymorphic Toxin Immunity (PT-Imm) systems). PT-Imm systems were identified in seven of the prophages, which include a WXG100 protein, large polymorphic toxin with an N-terminal WXG100 domain and C-terminal toxin domain, and an immunity protein. We previously showed that prophage-encoded PT-Imm genes contribute to increased drug resistance. The PT-Imm systems in these novel prophages will be cloned and tested for their effect on mycobacteria's drug resistance.

1101. Conditional Knockout of Celf4 from Mouse Sensory Neurons Induces Robust Mechanical and Thermal Hypersensitivity

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Madison Mueth, Eliza Grlickova-Duzevik, Peter Neufeld, Jill Ward, Christoph Straub

Faculty Mentor: Ben Harrison

Abstract: RNA binding proteins (RBPs) regulate gene expression by controlling RNA processing, fate, and function. Dysfunctional RNA processing and translation within the nervous system is a contributing factor to neurodegenerative disease and maladaptive pain. Computational analyses revealed CUGBP Elav-Like Family Member 4 (CELF4), an RBP suggested to regulate neurotransmission, as a candidate regulator of sensory neuron sensitivity. Previously, CELF4 expression has been characterized within the central nervous system where Celf4 deficient mice have abnormal excitatory neurotransmission that causes a complex seizure disorder. Considering these data, we sought to characterize CELF4 expression and function within the peripheral nervous system. Histological assessments of naïve rodent tissues revealed that CELF4 is highly expressed in capsaicin-sensitive sensory neurons. Genetically modified mice were used to assess the phenotype associated with knockout (KO) of Celf4 from sensory neurons. Behavioral analyses including von Frey, Hargreaves, Cold Plate, and Thermal Place Preference assays were used to characterize this phenotype. These revealed that conditional KO of Celf4 from sensory neurons induces a robust hypersensitivity to mechanical and thermal stimuli in male and female mice. Additionally, patch-clamp recordings showed acutely dissociated, capsaicin-sensitive dorsal root ganglia neurons become hyperexcitable following Celf4 KO. Together these data implicate CELF4 as a tonic suppressor of sensory neuron excitability and therefore a promising target for future therapeutic modulation of sensory neuron sensitivity in various pain conditions.

1102. Uncovering Factors Involved in Bacterial-Drug Synergy Against Candida

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Allie Conner, Siham Hattab, Nikhil Vaidya

Faculty Mentor: Robert Wheeler

Abstract: The fungus Candida albicans and the bacterium Pseudomonas aeruginosa are opportunistic pathogens that co-colonize multiple sites in humans, particularly in the immunocompromised lungs of Cystic Fibrosis (CF) patients and in mechanically ventilated patients. Co-colonized CF patients experience reduced lung function and poorer prognosis. Our previous findings established that Fluconazole, a fungistatic agent, displays fungicidal activity in the presence of P. aeruginosa. Synergy between Fluconazole and P. aeruginosa is partly due to iron piracy, however additional determinants remain unknown and our work aims to characterize these determinants. Mutants were identified from a library of homozygous deletion C. albicans strains that display tolerance to bacterial-drug synergy and we aim to categorize these mutations to elucidate tolerance mechanisms. We also aim to determine tolerance in clinical isolates from CF patients and in Candida species of importance identified in the WHO's Fungal Priority Pathogens List. Species displaying enhanced tolerant phenotypes will be investigated to identify physiological and metabolic differences. We expect to see that species-species differences could overlap with genes identified in the C. albicans library screen. Lastly, we aim to characterize P. aeruginosa determinants utilizing a nonredundant library of P. aeruginosa strain PA14 transposon insertion mutants. Fungicidal synergy of Fluconazole treatment and bacterial antagonism will be determined using NanoLuc® luciferase-expressing C. albicans. Identification of relevant bacterial pathways in Fluconazole-P. aeruginosa tolerance and fungal pathways that regulate P. aeruginosa responses expand knowledge of bacterial communication with Candida during infection and may increase effectiveness of clinical treatments.

1103. MicroRNA Regulation of Neutrophil Inflammation during Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Riley Grindle, Brandy Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: The infection from the influenza virus has hospitalized 140,000-710,000 people annually from 2010 to 2020. This is partially due to a hyperinflammatory response in the respiratory system caused by the innate immune system. Neutrophils play a major role in innate immunity as they are the first cells to respond to infection. The neutrophils migrate to the site of infection to engulf pathogens, release toxic reactive oxygen species (ROS), and recruit other immune cells to clear the infection. After clearing the infection, neutrophils migrate away to resolve inflammation. Hyperinflammatory responses due to neutrophil overactivation can result in tissue damage. Regulation of neutrophil activity could reduce tissue damage while still clearing the infection. MicroRNAs (miRNAs) are potent negative regulators of genes that work by binding with target mRNA and marking it for degradation. We hypothesize that miRNAs regulate the neutrophil-mediated response to influenza A virus (IAV) infection. Using two different zebrafish lines with neutrophil migration defects, the miR-199 (Tg(lyzC:miR-199-3-Dendra2)pu19) and miR-722 (Tg(lyzC:miR-722-Dendra2)pu6) overexpression lines, we assayed the expression of candidate miRNAs previously identified to be involved with neutrophil regulation during bacterial infection using qRT-PCR. We also assayed the expression of these two mutant lines following low-dose arsenic exposure. These studies help us understand the neutrophil response to IAV infection, and may provide us with alternative treatment through inflammation regulation.

1104. Novel Drug Treatments Improve Influenza A Virus Infections in Zebrafish Measured by Respiratory Burst Assay

Submission Type: Exhibit

Submission Category: Biomedical Sciences

Author(s): Mykayla Weinstein, Brandy-Lee Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza A virus (IAV) infection is a significant health concern, as 3 to 11 percent of individuals in the US become infected per year. Innate immune system cells are the first to respond to infection. Neutrophils are essential innate immune cells that play a critical role in facilitating protection by destroying pathogens through the production of reactive oxygen species (ROS). The production and release of ROS is a mechanism known as the respiratory burst response. Our overarching goal is to determine optimum levels of the respiratory burst response following IAV infection, while avoiding extensive host tissue damage. Our preliminary studies of a zebrafish model of IAV infection showed increased survival when ROS production is reduced. Additional preliminary data have suggested that the addition of low-dose (10 ppb) arsenic to zebrafish water reduces survival due to its high toxicity. We hypothesize that minimizing respiratory burst responses will diminish tissue damage and improve survival. Using a respiratory burst assay, we are able to induce ROS with phorbol myristate acetate (PMA) then visualize fluorescent product, 2',7'-dichlorofluorescein, that is generated when ROS oxidizes H2DCFDA, as a way to quantify the respiratory burst response. Recent results have demonstrated that arsenic exposure increases viral burden and decreases survival overall in IAV-infected zebrafish. Further study will help us evaluate the molecular mechanisms that regulate both the respiratory burst and innate immune responses.

1105. "Opp"-eration Nutrient Uptake: How the opp System Interacts with Prophages in GBS

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Katie Southworth, Caitlin Wiafe-Kwakye

Faculty Mentor: Melody Neely

Abstract: Group B Streptococcus (GBS) is a commensal bacteria that colonizes the vaginal tract of many pregnant women with no symptoms, but is an opportunistic pathogen in immunocompromised individuals, which include fetuses and neonates. Colonization of the vaginal tract during pregnancy puts the baby at risk of infection in utero and during labor. To combat this, women colonized with GBS are given antibiotics during delivery. In addition to the rise in antibiotic resistance, antibiotics can harm the natural flora and immune systems of both the mother and baby. Alternatives to antibiotics are needed, and understanding the role of prophages in bacterial infection may lead to a solution. Previous data in our lab show that GBS carry prophages, which are bacterial viruses that insert themselves into the GBS genome and often carry virulence factors. A phage-cured strain of GBS was created to analyze the impact of prophages on bacterial fitness. RNAseq analysis between wildtype and phage-cured GBS strains demonstrated changes in the expression of genes within the opp system, which can assist in nutrient uptake during cell stress. To determine the interactions between the opp system and prophages, an oppD knockout strain of GBS CNCTC 10/84 will be created to determine the impact of the opp system on GBS viability and virulence. Additionally, the wildtype and phage-cured strains will be compared in membrane permeability and cell viability assays to determine differences in survivability. Understanding how prophages influence nutrient uptake and viability may give insight into new treatments to treat bacterial infections.

1106. Investigating the Effect of Navitoclax on Hematopoietic Stem and Progenitor Cells during Clonal Hematopoiesis

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Shawn David

Faculty Mentor: Jennifer Trowbridge

Abstract: Central to studying hematopoiesis requires an understanding of where the hematopoietic stem/progenitor cells (HSPCs) reside i.e., the bone marrow (BM) microenvironment. The BM microenvironment is modulated by a multitude of factors such as aging, which could potentially lead to dysregulation of hematopoiesis. Aging can lead to accumulation of somatic mutations, most commonly observed in epigenetic regulators such as Dnmt3a, tet2, giving rise to a condition called clonal hematopoiesis (CH). These mutated clones tend to takeover other HSCs in the BM microenvironment and under selective pressures can give rise to hematologic cancers. Recent work in the lab utilized Dnmt3a mutant models to understand the mechanisms behind CH. It was found that Dnmt3a-mutant HSPCs can cause increase in senescence of mesenchymal stromal cells of the BM microenvironment. Senescence induced in stromal cell population of Dnmt3a mutants was observed to be reduced by using an inhibitor of anti-apoptotic proteins known as Navitoclax. But additionally, Navitoclax was also observed to decrease hematopoietic engraftment in Dmnt3a mutants. Therefore, the purpose of this project was to investigate if the drug directly affects Dnmt3a-mutant HSPCs or only affects the senescent cells, which in turn affect HSPCs, as a result of the crosstalk between the non-hematopoietic and hematopoietic compartment of the BM microenvironment.

1107. The Effects of Boi2 Mutations in Saccharomyces cerevisiae

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Samuel Deelsnyder

Faculty Mentor: Joshua Kelley

Abstract: In the yeast Saccharomyces cerevisiae, proteins known as septins form a structure at the bud neck and promote cytokinesis. In the presence of mating pheromone, septins promote production of the mating projection and are required for the yeast to track the pheromone to its source. The anillin-like protein Boi2 is important for cytokinesis, interacts with proteins required for mating projection formation, and is known to be phosphorylated in response to pheromone. We hypothesized that Boi2 may play a role in the pheromone response. We performed site-directed mutagenesis to alter serine at position 723 in Boi2, which is phosphorylated in response to pheromone. We examined the effects of blocking phosphorylation or mimicking phosphorylation of Boi2 on the pheromone response. To accomplish this, Boi2 was excised and inserted into the plasmid pRSII406 which was transformed into wild type yeast cells tagged with Bem1GFP and Cdc3 MCherry, which were subsequently imaged. Another test involved tagging Boi2 with GFP itself to view what effect a simple tag had on the formation of the cell.

1108. Environmental and Genetic Factors That Alters the Normal Macrophage Response to Pseudomonas aeruginosa

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Liz Saavedraperez, Carol H. Kim, Con Sullivan, Benjamin King

Faculty Mentor: Benjamin King

Abstract: The innate immune system is essential for responding to injury and infection but that response can be altered by environmental and genetic factors. Exposure to low-dose arsenic causes decreased overall innate immune function to opportunistic pathogens, such as Pseudomonas aeruginosa, but the mechanisms are not well understood. Genetic factors, such as the genetic disorder Cystic Fibrosis, also influence the innate immune response's dysregulation. The disorder is often characterized by a deficiency in the cystic fibrosis transmembrane conductance regulator (Cftr) protein that alters macrophage function. We utilize the zebrafish as a model system to study how arsenic and knockdown of the Cftr protein alter the innate immune response to infection by targeting its inhibitory mechanisms. Highly conserved non-coding RNAs, microRNAs, negatively regulate protein-coding genes. The expression of microRNAs was characterized in 48 hours post-fertilization control versus cftr morphants infected with Pseudomonas aeruginosa at 6 post-infection (hpi) following exposure to 0, 2, and 10 ppb arsenic. 81 microRNAs were differentially expressed with infection at 6 hpi and 2 ppb arsenic exposure. In control morphants, increasing concentrations of arsenic with infection altered the expression of macrophage genes that induce pathways significant for apoptosis and lysosome and phagosome development. Under the same conditions, the absence of Cftr downregulated the expression of genes involved in pathways required for resolution of inflammation. These studies, combined with survival and bacterial burden studies, will provide new insight into the mechanisms of innate immune responses, and inform on the dysregulating effect of arsenic on macrophage function.

1109. Using RNA Sequencing and Cloud Computing to Characterize How Defective Neutrophil Migration Impairs The Innate Immune Response to Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Emma Boudreaux, Eric Jestel, Sarah MacLeod, Steven Allers, Brandy-Lee Soos, Benjamin King

Faculty Mentor: Benjamin King

Abstract: Influenza virus is an ongoing major health concern as seasonal epidemics result in 290,000 to 650,000 annual global deaths from severe respiratory infections. The most predominant influenza virus type, influenza A virus (IAV), has caused seasonal epidemics as well as four global pandemics in the last century. Neutrophils are the first cells to respond to infection and serve a critical role in clearing pathogens and recruiting other immune cells. Our laboratory uses zebrafish as a model to study how the innate immune system responds to IAV. One zebrafish mutant we study expresses a transgene that impairs the migratory function of neutrophils. These zebrafish express a truncated form of the C-X-C chemokine receptor 4b (Cxcr4b) in neutrophils and have decreased survival to IAV infection over wild-type controls. To characterize how these mutants respond to IAV, we analyzed a RNA sequencing dataset to compare the gene expression of mutants compared to controls. We used virtual machines and Jupyter notebooks to run analysis workflows using Google Cloud Platform. We found over 200 genes to be differentially expressed with a false-discovery rate less than 0.05. Several pathways and Gene Ontology biological process terms were over-represented among these differentially expressed genes. Our analyses will help inform future functional studies to study the role neutrophils have in the response to IAV.

1110. PD-L1 Expressing Myeloid Cells Promote Bone Marrow Immunosuppression and Bone Loss with Diet-Induced Obesity

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Samantha Costa, Sergey Ryzhov, Moustapha Kassem

Faculty Mentor: Clifford Rosen

Abstract: Diet-induced obesity (DIO) is known to cause disruptions in immune and inflammatory responses that impair proper immunity, but the mechanism of this pathogenesis is poorly understood. The current paradigm links obesity to low-grade systemic inflammation. However, no preclinical studies have investigated the implications of bone marrow (BM) immunosuppression and obesity in non-tumor-bearing mice. We hypothesized DIO would generate an increase in program death ligand 1 (PD-L1) expressing myeloid cells with immunosuppressive and pro-osteoclastogenic capabilities. To test this, 8-week-old male C57BL/6J mice were fed a high-fat (HFD; 60% kcal) or sucrose-matched low-fat (LFD; 10% kcal) diet for 12 weeks. At a molecular level, isolated BM adipocytes from obese, HFD-fed mice did not have increased pro-inflammatory cytokine expression (IL1b, IL6, TGFb, TNFa, IFNg) compared to LFD-fed controls. The lack of inflammation within the BM stroma of obese, HFD-fed mice was accompanied by a significant increase in mature myeloid cells, CD11b-highCD11c-high ($p<0.0001$), with a significant increase in an immunosuppressive CD11b-highPD-L1+ subset ($p<0.0001$). In addition, our obese mice had a significant loss in trabecular and cortical bone volume that was the result of uncoupled bone remodeling through increased osteoclast number, enhanced eroded surface, and impaired osteoblast function, but no change in osteoblast number. The increase in osteoclast number in obese mice was coupled with an increase in CD11b-lowPD-1+ osteoclast precursors ($p=0.0042$). In conclusion, these data suggest DIO promotes an immunosuppressive BM microenvironment that promotes PD-1+ osteoclast precursors towards osteoclastogenesis. The downstream consequences of obesity-related immune impairment and associated bone loss remain to be elucidated.