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- Terence O'Brien
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- Joshua S. Stone
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- Hanna L. Brooks
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- Hadley Moore
- David Marcinkowski

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- Lilla Tilton-Flood
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- Robert Patenaude
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- Rajeev Bhattarai
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- Brandon Boxler
- Cynthia Loftin
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- Bouhee Kang
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- Abigail Hing
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- Maria Fiore
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- Alison Brodt
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- Samuel Akomea-Frempong
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- Yu-Ying Chen
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- Delaney Greiner
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- Rebecca Gumbrewicz
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- Emily Roth
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847. **Retroviral Strain Diversity and Spatial Distribution in Wild Turkeys to Assess Agricultural Spillover**

- Claudia Desjardins
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- Olivia Choi
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850. **The Remarkable Diversity of Repetitive DNA Composition and Abundance Among Mice**

- Caleigh Charlebois
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- Shawn Fraver

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- Michelle Volk
- Allison Gardner

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- Nicole Ramberg-Pihl
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- Ashish Alex
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- Abigail Wiegand
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- Stephanie Hurd
- Laura Kenefic
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- Libin Thaikkattil Louis
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- SuriyaPrakaash LakshmiBalasubramaniam
- Balunkeswar Nayak
- Avinash singh patel

859. **Establishing the Connection Between White Adipose Tissue Sensory Innervation and Energy Balance**

- Dylan Taplin
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- Kristy Townsend

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- Lauren Maher
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- Dr. Daniel Hayes
- Cynthia Loftin

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- Meredith Lewis
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- Alex Revello
- Lauren Maher
- Daniel Hayes
- Cynthia Loftin

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- Akila Harishchandra
- Casey Lindberg
- Richard T. Di Giulio
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- Anna Schumann
- Dakota Archambault
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- Amelia St. John
- Caitlin Wiafe-Kwakye
- Sally Molloy
- Melody Neely

1005. **The Role of Prophage McProf in M. chelonae Antibiotic Resistance**

- Sarah McCallister
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- Brandy Soos
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- Mary Astumian
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- Gabriel Jensen
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- Patrick Fleming
- Grace LaFrance
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- Haley Foreman
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- Keith Hutchison
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- James Seuch
- Brandy-Lee Soos
- Con Sullivan
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- Brian Elsemore
- Robert Wheeler

1033. **The impact of BPs lytic infection on pathogenic Mycobacterium chelonae and viral gene expression profiles**

- Colin Welch
- Matt Cox
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- Sally Molloy

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- Christian Potts
- Bright Obeng
- Bailey West
- Suraj Sangroula
- Marissa Kinney
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- Marissa Kinney
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- Bailey Carter
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- Kathryn Patenaude
- Siham Hattab
- Dr. Melody Neely
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- Cara Sullivan

- Jun Lee
- Ian Meng

1039. **AAV9-Ighmbp2 Gene Therapy Significantly Improves Motor Performance in Severe SMARD1-like Mouse Model, nmdem3**

- Sarah Holbrook
- Greg Cox

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- Christine Hale
- Ramaz Geguchadze
- Samia Pratt
- Julie Moulton
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- Kayla Barton
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- Brian Olsen
- Benjamin King

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- Jaycee Cushman
- Emma Freeman
- Sarah McCallister
- Keith Hutchison
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1043. **JC Polyomavirus Infectivity is Reduced by Inhibition of Calcium Signaling Pathways**

- Avery Bond
- Mason Crocker
- Melissa Maginnis

1044. **Biointerface of Cellulose Nanofibril Material for Application as Botanical Wound Dressing**

- Marissa McGilvrey

- Caitlin Howell

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- Sahar Roozbahani
- Jacob Halbrook
- Michael Mason

1046. **Muscle Fiber Transmembrane Protein Localization in a Zebrafish Dystroglycanopathy Model**

- Mary Astumian
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- George C. Murray
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- Robert Burgess

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- Elizabeth Whitmore
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1050. **Caloric Restriction and Fasting Diets have Negligible, or Potentially Damaging, Effects on Cognition in Diversity Outbred Mice**

- Andrew Ouellette
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1051. **Characterizing the role of IRS1/2 in osteocyte differentiation and function in bone development**

- Vivin Karthik
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1052. **Prrx1-CreAlplfl/fl mice, a Model for Further Investigations into the Pathophysiological Changes in Hypophosphatemia.**

- Victoria DeMambro
- Jennifer Daruszka
- Daniel Brooks
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1053. **Chronic Cortisol Works Through the Transcription Factor Klf9 to Deregulate Immune Response and Metabolism**

- Ian Gans
- Elli Hartig
- Joel Graber
- Jim Coffman

1054. **Evidence for Direct Projections of Corneal Primary Afferent Neurons to the Parabrachial Nucleus in Mice**

- Megan Tomasch
- Ian Meng

1055. **Comparision of CRISPR-X and EvolvR for Saturation Mutagenesis of HBE1 locus cis-regulatory elements**

- John Butts
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1056. **Identification, Notification, and Quantification of Bubbles in Microfluidic Systems**

- Mikaella Sansoucie
- Bailey Corless
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1057. **Discovering Virulence Factors of Candida albicans that Affect Host Responses**

- Emma Bragdon
- Bailey Blair

- Robert Wheeler

1058. **Utilization of a novel approach to decode the mechanisms of a fatal viral brain infection**

- Francesca Armstrong
- Michael Wilczek
- Remi Geohegan
- Melissa Maginnis

1059. **Identifying the Link between Non-coding, Regulatory RNAs and Phenotypic Severity in Muscular Dystrophy**

- Grace Smith
- Clarissa Henry
- Mary Astumian
- Michelle Goody
- Erin Bailey

1060. **Lymphatic System as a Conduit for Immune Cells in Fat**

- Thomas Szewczyk
- Magdalena Blaszkiewicz
- Matthew Karp
- James Godwin
- Kristy Townsend

1061. **Triclosan Disrupts Immune Cell Function by Depressing Ca2+ Influx via Acidification of the Cytoplasm**

- Alan Baez
- Suraj Sangroula
- Prakash Raut
- Bright Obeng
- Juyoung Shim
- Grace Bagley
- Julie Gosse

1062. **Innate Immune Response to Influenza Type A in a Zebrafish Model**

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

1063. **Role of MicroRNAs in Regulating the Innate Immune Response to Pseudomonas aeruginosa Infection.**

- Liz Saavedra
- Brandy Soos
- Benjamin L. King

1064. **Sclerostin antibody normalizes decreased trabecular bone and increased bone marrow adipose tissue caused by whole-body irradiation in mice**

- Samantha Costa
- Michaela Reagan

1065. **Uncovering Candida albicans factors that modulate the host phagocyte response**

- Bailey Blair
- Emma Bragdon
- Lena Stasiak
- Robert Wheeler

1066. **The Meninges and Choroid Plexus are Prominent mTert-Expressing Adult Stem Cell Niches in the Mouse Brain**

- Gabriel Jensen
- Kristy Townsend

1067. **Drawing the road map to JC Polyomavirus infection in the brain: Using bioinformatics to elucidate the cell signaling pathways activated upon virus infection**

- Michael Wilczek
- Francesca Armstrong
- Remi Geohegan
- Melissa Maginnis

1068. **Defining Localization Dynamics of 5-HT2 Receptor Subtypes in JCPyV Entry Using Super-Resolution Localization Microscopy**

- Kashif Mehmood
- Jeanne DuShane
- Matthew Parent
- Michael Wilczek
- Colleen Mayberry
- Francois Levasseur
- Melissa Maginnis

1069. **Wound-Induced Polyploidization Enables the Drosophila Abdominal Epithelium to Adapt and Become Muscle-Like to Restore Tissue Mechanics**

- Kayla Gjelsvik

- Vicki Losick

1070. **Murine Myeloma Model Demonstrates Correlation Between Body Composition and Tumor burden**

- Sasha Weller
- Heather Campbell
- Michaela Reagan

1071. **DGAT Activity is Dispensable for Myeloma Cell Proliferation**

- Connor Spencer Murphy
- Michaela Reagan

1072. **Utilizing mouse telomerase reverse transcriptase (mTERT) as a novel adult stem cell marker to visualize adult cell turnover in the mouse brain.**

- Ashleigh Beaulieu
- Gabriel S. Jensen
- Lydia Caron
- Kristy Townsend

1073. **Engineering Zebrafish Constructs to Test Whether Muscle-Disease Associated MYLPF Variants are Sufficient to Impair Sarcomere Assembly**

- Teresa Easterbrooks
- Jared Talbot

1074. **Rab27a in Exosome Function in Perivascular Adipose Tissue**

- Ashley Soucy
- Larisa Ryzhova
- Samantha White
- Benjamin Tero
- Bethany Fortier
- Anne Harrington
- Lucy Liaw

1075. **Rab27a Expression in Perivascular Adipose Tissue Changes Upon Differentiation**

- Caitlin Stieber
- Joshua Boucher
- Jacqueline Turner
- Lucy Liaw

1076. **Progression of Cardiomyogenesis from Embryonic Stem Cells in a Three-Dimensional Gel Matrix**

- Jonathan Bomar
- Rosemary Smith

1077. **Sending Signals: Adipose Sensory Nerves May Communicate to the Brain via Lipid Metabolites**

- Cory Johnson
- Jake Willows
- Kristy Townsend

1078. **The mechanisms of TAp63-dependent and -independent DNA damage response in meiotically arrested oocytes**

- Monique Mills
- Chihiro Emori
- Zachary Boucher
- Ewelina Bolcun-Filas

Physical and Mathematical Sciences

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Physical and Mathematical Sciences

101. **Synthesis of Photoswitchable Triptan Derivatives and Evaluation of their Activity on Serotonin Receptors**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Chelsea Sainsbury, Undergraduate

Faculty Mentor:
Michael Kienzler

Abstract:
Serotonin (5HT) is a neurotransmitter in the human body that is used to control a variety of functions such as regulating heart rate. Serotonin targets serotonin receptors that are linked to diseases such as depression and migraines. Triptans are a series of compounds that bind to the 5HT1B or 5HT1D receptors to treat migraines. The structures of these compounds are the basis for this project. The synthesis of a series of azobenzene functionalized triptan derivatives will be achieved through the reaction of 5-nitroindole with both dimethylamine and diethylamine to produce two key indole intermediates. A set of functionalized azobenzenes will then be used to generate a series of photoswitchable triptan compounds. An azobenzene is a photoswitch, which is a compound that changes conformation upon the application of UV light. The photochemical properties of the ligands will be characterized and then their activity will be tested on the serotonin receptors. The hypothesized products are photoswitchable triptan derivatives that we expect to bind to the 5HT1B or 5HT1D receptors in one conformation, but not the other. From this, we hope to achieve the photocontrol of the 5HT1B/D receptors.

102. **Utilization of Methacrylate Functionalized Cellulose in Emulsion Polymerization for Use as Biodegradable Reinforcements**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Christopher Phelan-Soper, Undergraduate

Faculty Mentor:
William Gramlich

Abstract:
One of the biggest threats facing civilization is the overuse of plastic leading to immense amounts of harmful waste. Many commercial plastics take several years to decompose and the worst can require decades to break down. My research goal is to chemically modify the surface of cellulose fibers to allow for efficient use as a biodegradable and biorenewable reinforcement for common plastics. This was done by promoting hydrophobic nature through forming covalent micelles then testing drying times to assure that the modification shortens it significantly. The first step is functionalizing primary alcohols on cellobiose repeat units with reactive methacrylate functional groups to create the sites to form covalent bonds yielding MetCNF. After these groups are detected an emulsion polymerization of methyl methacrylate is performed in presence of the made MetCNF to form polymethyl methacrylate micelles that covalently bond to the methacrylate sites. The made PMMA-MetCNF: polymethyl methacrylate micelles bonded to methacrylated cellulose, is then tested via infrared spectroscopy and soxhlet extraction to identify key C=O stretching from conjugated esters as part of the polymethyl methacrylate micelles. Results show that an increase in the ~1730 1cm after soxhlet extraction indicates covalent bonding of the micelles to the functional groups. Further characterization was done through systematic filtration to prove increased hydrophobicity and SEM to monitor morphological patterns from the emulsion polymerization.

103. **Photoswitchable CRAC Channel Inhibitors**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Ryan Bray, Undergraduate

Faculty Mentor:
Michael Kienzler

Abstract:
Calcium ions are important intracellular messengers that regulate cellular processes such as the immune system, release of neurotransmitters, and cell death. The movement of calcium in and out of cells is regulated by calcium channels. Calcium release activated channels, or CRAC channels, are a specialized calcium ion channel that are particularly important in immune system function. However, defects in CRAC channels can cause defects in the immune system can lead

to severe Combined Immunodeficiency disorder (SCID). CRAC channel inhibiting compounds have been developed with the goal of treating SCID and other conditions; however, there are no CRAC channel inhibitor drugs currently approved for use on people due to their side effects and toxicity. My goal is to take existing CRAC channel inhibitors and alter their structure to allow photoswitching activity. Azobenzene is a compound that changes its shape under different wavelengths of UV light. I will be synthesizing azobenzene derivatives of existing CRAC channel inhibitors to control whether the compounds are active or not by controlling the light they are exposed to. This could reduce side effects and toxicity by controlling drug expression spatially and temporally.

104. **Utilizing Magnetic Nanoparticles to Detect Aqueous Mercury with Infrared Spectroscopy**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
David Howe, Undergraduate

Faculty Mentor:
Carl Tripp

Abstract:
The overarching goal of our research is to develop a field deployable system to detect mercury in water sources. The aim of my research was to develop a collection system that could concentrate and provide a unique signature that would be detectable by a portable infrared spectrometer. A key aspect of our approach is the use of magnetite nanoparticles containing attached thiosemicarbazide groups which react in the presence of mercury to form a cyclic species. Reaction occurs on a one to one basis between the functional groups and mercury allowing for a direct relation between observed signal and concentration of mercury. Use of magnetite will allow the use of a magnet to preconcentrate the nanoparticles from the reaction vessel. Work performed thus far has been concerned with measuring the degree to which bare magnetite nanoparticles uptake mercury prior to functionalization. This uptake was observed to take place and we have overcome this hurdle by applying silica coating to the magnetite particles. Work yet to be performed includes determining lower limit of detection of mercury using this method. This will be accomplished by allowing the nanoparticles to react with a mercury solution of known concentration before collection on a fluid permeable membrane that is transparent in the infrared region, thus enabling recording infrared spectra in transmission mode directly through the membrane.

105. **Enantioselectivity Determination of Lactic Acid Synthesized Using a Tungsten Oxide Catalyst**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Megan Arsenault, Undergraduate

Faculty Mentor:
Brian Frederick

Abstract:
Polylactic acid (PLA) is a sustainable, biodegradable bioplastic but is limited by its high flexibility and low temperature threshold, which means that it is not as durable as fossil fuel-based plastics in holding hot food or beverages. PLA is typically produced through the fermentation of glucose. Scale-up of fermentation is economically unfavorable and the properties of PLA would be improved if a source of the pure D-lactic acid were found.1 In previous experiments, where woody biomass was converted to an alternative fuel, glucose was reacted over a tungsten oxide (m-WO3) catalyst and produced lactic acid, along with formic acid and fructose. Lactic acid, if in a 1:1 ratio of L and D conformers, can be used to make PLA that has better thermal and mechanical stability. Lactic acid exists in the form of enantiomers, which are mirror images of each other. Enantiomers are nearly identical in identifying properties except optical rotation. A method was successfully developed to determine the enantioselectivity of lactic acid by isolating and analyzing the lactic acid byproduct of the m-WO3 catalyzed reaction. The lactic acid and the other byproducts were derivatized and analyzed using gas chromatography and mass spectrometry, without the need for a chiral column. Preliminary data indicates the product has some enantiomeric excess of the L-lactic acid.

106. **Iterative Synthesis of Photoswitchable Azobenzene Based TREK-1 Potassium Channel Blockers**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Colin Gotschlich, Undergraduate

Faculty Mentor:
Michael Kienzler

Abstract:
The goal of this project is to synthesize a series of azobenzene-based blockers for the TREK-1 potassium channel. The control of these TREK-1 channels can allow the exploration of the relationship between the channels and conditions such as depression, epilepsy, dementia, migraines and other conditions linked to the TREK-1 channels. An azobenzene is used as the basis of this blocker because this compound is designed to be photo-reactive, this allows the compound to selectively inhibit the TREK-1 channel. The particular blockers being synthesized in this portion of the project consist of short carbon chains linking a quaternary ammonium to the carbonyl on the secondary amine on the para position of the azobenzene. The lengths of the carbon chains on the quaternary ammonium will also be altered to determine how this affects the blocking of the channel. The chain linking the carbonyl to the quaternary ammonium is being shortened as this moves the photo switchable piece of the compound closer to the binding site, which should have more of an effect on the channel. Once synthesized and purified, these compounds are tested by a collaborator's lab for their physiological effects. By altering the lengths of the linking chain and the alkyl chains on the ammonium, different effects should be observed when tested with the TREK-1 channels.

107. **The Effects of Community Structure on Disease Transmission in Metapopulation Networks**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Cole Butler, Undergraduate

Faculty Mentor:
Brandon Lieberthal

Abstract:
Infectious diseases can be mathematically modeled over large human populations via the use of metapopulation networks. Metapopulation networks consist of a system of nodes connected by edges, where the individual nodes represent population centers, e.g. towns and cities. In our study, we looked at using community structures, a collection of nodes that share more connections within the community than the surrounding network, to study heterogeneous population densities within the network. This is equivalent to improving the spatial resolution of

human mobility from the scale of cities to the scale of individual city blocks. To achieve this, an individual node in a network was substituted with a community of nodes, imitating greater spatial resolution. We were interested in how this greater spatial resolution could potentially affect the dynamics of disease spread in the overall network. Specifically, we observed which topological features of the original human network can help to determine the extent of change created by community substitution, such as changes in peak infection rates, local establishment time, and super spreader capacity, The results of this study will help us to improve future disease epidemic simulation by determining which nodes in a metapopulation network would significantly change the results of the simulation by being substituted by a community structure, and in the reverse direction, which communities can be simplified as nodes without significantly altering the dynamics of disease spread. Preliminary results show that communities with high connectivity and centrality are most significant in influencing the dynamics of the disease epidemic.

108. **Second-Order Derivatives of Nonsmooth Functions with Applications in Engineering**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Abram Karam, Undergraduate

Faculty Mentor:
Peter Stechlinski

Abstract:
Derivative information is a fundamental tool widely used in solving practical problems in engineering and the sciences. Such information is used in classical theory and methods for equation solving, differential equations, and optimization. However, many real-world problems, such as those found in process systems engineering and civil engineering, exhibit non smoothness in the form of discrete events, which often means derivative information is unavailable or inaccurate. This has necessitated generalizations of the classical derivative which have been made by a number of authors. Clarke's generalized derivative is useful in nonsmooth equation solving and optimization, but was hard to calculate in general until a recently developed tool in lexicographic differentiation. The aim of this project is to extend the theory of generalized derivatives to evaluate second-order generalized derivatives in an accurate and automatable way. Motivated by applications of interest in engineering, this project aims to extend results from classical differentiation and first-order generalized derivatives theory for the purpose of improving accuracy and convergence of nonsmooth methods.

109. **Clouds, Cameras, and Composition: Characterizing spectral differences between co-located Pandoras**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Margaret Turcotte Seavey, Undergraduate
Alexander Kotsakis
Joseph Robinson
Robert Swap

Faculty Mentor:
David Batuski

Abstract:
Pandora spectrometer instruments are built and calibrated the same way, however variability in total column nitrogen dioxide (NO2) between co-located Pandoras occurs. There are consistently co-located Pandoras at NASA GSFC that provide ample datasets for analyzing subtleties between instruments. The causes of spectral differences between co-located Pandoras should be characterized to quantify and reduce these differences. This results in a better understanding of the Pandora instrument and how atmospheric and instrumental variability impacts retrieved nitrogen dioxide. A variety of factors contribute to spectral differences between co-located Pandoras. Clouds never appear in perfect shape and there are different cloud types that form at different altitudes. Instrumentation setup affects the retrieved total column NO2 because there are different Sun-tracking processes that are dependent on camera attachment. It has been observed that total column NO2 observations by co-located Pandoras capture the same characteristics throughout the day but there are instances where the magnitude of delta between observations is different. We can reasonably say that NO2 is heterogeneous by nature and through a combination of these factors leads to the delta being different between co-located Pandoras. Future work is needed to further quantify the impacts of the field calibration reference, cloud optical thickness and hyperlocal NO2 heterogeneity on the correlation between co-located Pandoras.

110. **Finding Appropriate Mass Functions and Other Internal Structures for Galactic Dark Matter in Simulation**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Zachary Smith, Graduate Student

Faculty Mentor:
Neil F. Comins

Abstract:
Experimental observation of galaxies and galaxy clusters have consistently provided evidence that they do not behave as expected in the current theory of gravity. The amount of mass that is calculated from luminosity, and therefore stars, is significantly smaller than what is required for the systems to be gravitationally bound. The additional mass that theories of gravitation need to describe the motion is called dark matter, since it does not seem to interact with electromagnetic radiation. The many candidates for dark matter have theories that usually attempt to explain most of the mass as their own, singular candidate. However, reality could easily have a mixture of the proposed forms and phenomena, even if in relatively small amounts. As a result, the parameter space defining the mass function and other characteristics of dark matter halos is less strictly confined. This project will explore many variations of a simulated galaxy with MACHOs (MAssive Compact Halo Objects), a central SMBH (SuperMassive Black Hole), a scalar field, a formation less gas, a star-forming gas, and stars. Each of these variations will be allowed to relax into a stable configuration, which will then be restructured to agree with observations, and then allowed to relax again in a Monte Carlo fashion. Eventually, a convergence should emerge that will provide, among other things, a better upper limit on the galactic population of black holes or other MACHOs as a component of dark matter.

111. **Surface modification of spray dried cellulose nanofiber in supercritical CO2**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Sabrina Sultana, Graduate Student
Douglas J. Gardner

Faculty Mentor:
Carl P. Tripp

Abstract:
Cellulose nanofiber (CNF) has found widespread application as filler material for different polymer matrices to enhance mechanical properties. The major obstacle to blend CNF into the

polymer matrices is its hydrophilicity. Modifying the cellulose hydroxyl groups with hydrophobic chain can incorporate hydrophobicity in cellulose which can improve the dispersion of CNF in hydrophobic polymer matrices. In this poster, we will present data on the surface modification of cellulose nanofiber through esterification in super critical CO2. The efficiency of the reaction is studied by changing different parameters such as type and chain length of the esterifying agent, temperature of the reaction, catalyst amount and time. The produced material is characterized using FTIR, X-Ray diffraction and Electron Microscopy. Control experiments performed with a vapor phase reaction show that using supercritical CO2 as the medium for performing the reaction leads to a 100 times higher amount of surface reaction is observed. Furthermore, the morphology of the CNF remained unchanged as the supercritical CO2 as a fluid has no surface tension.

112. **Synthesis and Characterization of Yttria-Stabilized Zirconia Thin Film Materials for Use in Harsh Environment Sensors**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Firas Mahyob, Graduate Student
George Bernhardt
Robert Lad

Faculty Mentor:
Robert Lad

Abstract:
Yttria-stabilized zirconia (YSZ) is widely used as a bulk ceramic in solid oxide fuel cells (SOFC) and high temperature oxygen sensors due to its high ionic conductivity, chemical inertness, and stability up to 1500oC. In thin film form, YSZ is an attractive component for use in miniaturized wireless microwave acoustic sensors to monitor conditions within harsh industrial environments. In this work, RF-magnetron sputter deposition was used to synthesize YSZ (8%Y2O3-92%ZrO2) films with thicknesses from 15nm to 200nm on piezoelectric langasite (La3Ga5SiO14) substrates at growth temperatures from 30oC-600oC. X-ray diffraction indicated that the cubic YSZ films grow with preferred (111) out-of-plane texture on the langasite substrate with random in-plane orientation. Post-deposition thermal annealing up to 1000oC leads to an increase in grain size and strain relief within the films as determined by the Williamson-Hall x-ray diffraction method. Scanning electron microscopy reveals the presence of hillocks on the YSZ film surface due to strain effects across the YSZ/langasite interface, and this

strain was minimized using a 400oC deposition temperature where extremely smooth films were obtained as determined by x-ray reflectivity. Post-deposition air annealing caused yttria segregation to the film surface region as evidenced by increases in the Y3d/Zr3d photoelectron peak area ratio upon annealing up to 1000oC. Electrochemical impedance spectroscopy showed that yttria segregation is accompanied by a decrease in thin film ionic conductivity. Ionic conductivity was found to be a function of the deposition temperature and thermal annealing treatments, and is strongly dependent on the film grain size.

113. **Growth Method for High Quality Piezoelectric AlN Films Used in Acoustic Wave Sensors**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Morton Greenslit, Graduate
Robert Lad
Mauricio Pereira da Cunha

Faculty Mentor:
Robert Lad

Abstract:
AlN films offer advantages compared to piezoelectric single crystal substrates for use in Surface Acoustic Wave (SAW) sensor devices, including flexible SAW device configurations, higher operating frequencies, and high temperature performance up to 800oC. In this work, a plasma-assisted epitaxy method is presented to achieve high quality AlN (0002) films on c-sapphire using e-beam evaporation of Al in an RF nitrogen plasma at a growth temperature of 930oC. A pre-nitridation treatment of sapphire was found to be beneficial in creating a seed layer for AlN epitaxy. RHEED analysis and XRD pole figures indicate that (0002) AlN grains also have in-plane registry with the sapphire substrate. SAW resonator devices operating near 450 MHz with different transducer and reflector configurations were patterned on the AlN/sapphire films. Admittance and impedance plots determined from S11 measurements indicate that defects and oxygen impurities in the AlN films strongly influence overall SAW resonator performance. Integration of these AlN films into next-generation sensors are expected to enable higher signal-to-noise and long-term sensor stability in harsh environment applications.

114. **Investigating the Mechanisms Behind the Emergence of Magnetic Properties in Nominally Nonmagnetic II-VI Semiconducting Nanocrystals**

Submission Type: Poster
Submission Category: Physical Sciences

Author(s):
Alex Khammang,

Faculty Mentor:
Robert Meulenberg

Abstract:
Semiconducting nanocrystals (NCs), such as CdSe NCs, possess striking size-dependent optical properties and have been shown to have applications as both optoelectronic and biomedical devices. These types of materials consist of an inorganic core, which dictates most of the physical properties, and an organic surface, that dictates chemical stability. Recently, reports on CdSe NCs, reveal paramagnetic (PM) over diamagnetic (DM) properties as a result of the surface. By engineering the magnetic properties of the surface layer and combined with the optical properties of the core, a new class of multifunctional nanomaterial may arise to improve upon targeted drug delivery and magnetic hyperthermia treatments.

To gain further insight on how the surface layer affects the magnetic properties, our current work focuses on altering the NC Surface chemistry by controllably varying the organic surface ligand concentrations on spherical CdSe NCS. This work reveals that CdSe NCS exhibit weak PM properties in the presence of an external magnetic field. However, sequential ligand removal does not yield a proportional response to the magnetic properties, but in general the PM properties are enhanced after the partial removal of surface ligands. We hypothesize that after the removal of surface ligands, the surface has as an increased number of unpaired electrons on Se atoms which may form Se-Se bonds. Density functional theory (DFT) calculations suggest that after completely removing the organic ligands from a facet, an energetically favorable Se-Se triplet state forms over a singlet state and may be a source of magnetism in this system.

115.**An Improved Method For Detecting Trace Level Phosphate/Arsenate in Water Using Transparent H-PTFE Membrane by UV-VIS Spectroscopy**

Submission Type: Oral Presentation
Submission Category: Physical Sciences

Author(s):
Nayeem Ibnul, Graduate

Faculty Mentor:
Carl Tripp

Abstract:
The conventional UV-Vis spectroscopic detection method requires target analytes to be soluble or have enough vapor pressure for analysis in the gas phase. Typically, a Beer Lambert's law relationship is used where the detection limit is dependent on the pathlength of the beam in the absorbing medium. To circumvent the limit in detection posed by the pathlength of the cell, we have developed a simple, fast and inexpensive method for conversion of target analytes present in solution or the gas phase to a solid for quantification by UV-Vis spectroscopy. The approach involves forming a precipitate with the target compound and then passing a known volume of the suspension through a transparent membrane to capture target analytes from aqueous solutions. We demonstrate this new method with the detection of phosphate and arsenate as both the analytes are essential parameters in determining the quality of water. In this presentation, I will describe how we reached a detection limit of 0.50 µg/L phosphate and 5 µg/L arsenate using a modified approach to the molybdenum blue method to form a precipitate combined with the use of a UV-Vis transparent membrane.

116. **Determining Influential Parameters in Glucose-Insulin Kinetics and Riot Spread**

Submission Type: Oral Presentation
Submission Category: Physical Sciences

Author(s):
Matthew Ackley, Graduate

Faculty Mentor:
Peter Stechlinski

Abstract:
Dynamical systems are predictive models used to make inferences and gain insights about a wide range of real-world problems in which data collection may be difficult, expensive, or not possible. In many cases, these models contain points where behavioral switches or "tipping points" occur, and such models are therefore referred to as "nonsmooth". Examples of non smoothness are found in models of bodily glucose-insulin kinetics, where insulin release is suddenly triggered by a biochemical threshold; a similar switch is found in models of riot spread

in which the likelihood of individuals to join the riot switches at a threshold value. In such applications, it is often of interest to determine which of the model parameters are “most important” - that is, which parameters are the most influential to the long-term behavior of the system. However, in nonsmooth systems, classical methods of determining this information based on derivatives may fail. In this talk, we will discuss how recent advancements in generalized derivative theory make the attainment of this sensitivity information possible. Simulations of the two aforementioned problems are provided and discussed.

117. **Catalytic Carbon-Carbon Bond Coupling for Producing Bio Jet Fuel from Mixed Organic Acids**

Submission Type: Oral Presentation
Submission Category: Physical Sciences

Author(s):
Elnaz Jamalzade, Graduate
Koorosh Kashkooli
Liam Griffin
G. Peter van Walsum
Thomas J. Schwartz

Faculty Mentor:
Thomas J. Schwartz

Abstract:
Biomass has received considerable attention as a suitable feedstock to replace crude oil for producing both energy and value-added compounds. Our primary research goal is to produce value-added bioproducts from local woody biomass resources using a combination of chemical and biological processing. The mixture of medium-chain-length carboxylic acids obtained from methane-inhibited open-culture anaerobic fermentation of lignocellulosic biomass is suitable for further oligomerization using heterogeneous chemical catalysis. The target product is a mixture of C10 –C20 molecules that is suitable blend-stock for mixing with existing hydrocarbon jet fuel. In this project, we have achieved more than 86% conversion of a model feedstock (ethyl hexanoate) into a wide range of C7-C19 molecules using bifunctional metal/mixed-oxide catalysts. In particular, we found that Pd/CeZrOx is highly selective and stable under reaction conditions. This catalyst achieves more than 90% selectivity to C11 or greater compounds.
We have used bulk methods (e.g., XRD) to determine the atomic-scale structure and composition of the catalyst. The XRD pattern of calcined 0.25% Pd/CeZrOX showed mainly the CeO2 fluorite-cubic structure, consistent with other reports. Conversely, there were no reflections in

the diffractogram that were attributable to Pd, indicating the presence of small particles. This information will ultimately be used for designing a highly optimized catalyst for biojet fuel production.

Business

Projects 201 - 205

Business

201. **Local Influences on Taco Bell's Global Operation**

Submission Type: Poster
Submission Category: Business

Author(s):
Vincent Russo, Undergraduate

Faculty Mentor:
Stefano Tijerina

Abstract:
Taco Bell’s transition from a national company to an international organization involved the analyzation of local dynamics. Analyzing local cultures carefully and adapting business practices to their tastes, religion, and lifestyle proved to be worth the effort because they now operate in twenty-six countries. Local tastes vary from market to market, so Taco Bell adapts the menu to fit what the customer expects to see, like more spice in Korea. Religious beliefs, like cows are sacred in India influence the menu to not include beef in India to avoid offending the culture. Lifestyles can vary from place to place, for fast paced dynamics, drive throughs are necessary. Lifestyles also include the differences in habits between generations. Taco Bell uses social media to reach younger generations and can adapt is messages to fit different cultures of young people using psychographic analysis. Success has driven Taco Bell to set goals of opening thousands more restaurants as opposed to closing restaurants like fast food competition Dunkin had to do in India. Moving forward Taco Bell must continue analyzing the markets it does business and in adapt is menu, style, and service to the culture it exists in. Other companies should do the same if they plan on being successful because a successful business model in one market is not guaranteed to be successful in another one.

202. **Emotional Engagement of Consumers: A Case Study Between Peloton And Classpass And Their Differences in Branding Initiatives on The Facebook Platform**

Submission Type: Poster
Submission Category: Business

Author(s):
Meredith Stephens, Undergraduate

Faculty Mentor:
Stefano Tijerina

Abstract:
This thesis investigates two companies whose products offerings are alike, yet their branding via the Facebook platform is different. Throughout this thesis, there will be research gathered from organic Facebook posts between the two companies' brand pages on the Facebook Platform. The research consists of total reactions as well as comments on a per post basis for various posts throughout September of 2018 and 2019. The raw data that this thesis will be using will be positive emotionality scores from LIWC (after comments are entered and run through the software) as well as the total number of reactions (likes, loves, WOWs, etc.) that correspond to the post the comments are drawn from. Following the collection of this data, the coding software R will be used to determine significances between the two companies LIWC scores and total reactions, assessing which company received higher reaction rates and more positive emotionality. There are two hypotheses that are associated with this data. The first one is that because Peloton uses a single Facebook page for both of their product offerings, then Peloton will have more overall reactions on their organic content than ClassPass and ClassPass Live have individually. The second hypothesis is that because ClassPass and ClassPass Live choose to separate their product offerings on Facebook into two identities, then ClassPass and ClassPass Live will each individually receive comments on their organic posts that reveal more positive emotions than Peloton. This thesis is informative because it presents a clear answer as to which branding strategy is the most effective for gaining the optimal number of reactions as well as positive emotionality on comments on organic content via the Facebook platform. Additionally, the research this thesis presents can aid in further studies for branding initiatives not only on the Facebook platform, but across all social platforms whose metrics are different yet equally important for a brand's effectiveness with consumers.

203. **On The Accuracy of IPO Underpricing in Different Sectors of the Stock Market**

Submission Type: Poster
Submission Category: Business

Author(s):
Samuel Varga, Undergraduate
Faculty Mentor:
Grant Miles

Abstract:
Is there variability between the level of accuracy in underpricing of IPOs in different sectors of the stock market? Can we find new independent variables that predict the level of underpricing? The purpose of this study was to examine the accuracy of IPO underpricing in different sectors of the stock market. We tested the short-run performance (relative to the S&P 500) of IPOs in the past five years (2015-2019) at four time-stamps (offer to first open, first close, 1 week, and one month). The statistical analysis showed that there is significant variability between the sectors at each time stamp, and we discovered that at one of the four time-stamps the different sectors do not behave uniquely. We focused on providing possible explanations for these results by referring to classical equity valuation techniques, social construction theory, and behavioral finance. We also used the regression model to test if four independent variables (market cap, total debt, net income, EBITDA) predict short-run IPO performance. The results show that none of the four do in any sector, except Real Estate. In the sectors with consistent results the findings reaffirm our anticipation that these variables are built into the initial offering price.

204. **The World Trade Organization and World Banks Relationship With the Private Sector and its Effects When Dealing with Underdeveloped Economies**

Submission Type: Poster
Submission Category: Business

Author(s):
James Kilroe, Undergraduate

Faculty Mentor:
Stefano Tijerina

Abstract:
In a growing global market, global interaction is essential for profit. This is why multilateral organizations like the United Nation agencies work closely with private organizations every day. I will aim my presentation through research that is centered around the World Trade Organization and World Bank. These types of organizations are interdependent with the private sector of business. The World Trade Organization and World Bank breakdown into many different sectors that have specific purposes. These agencies/organizations are often referred to as the “members” or “arms” of the World Trade Organization and World Bank. This includes but is not limited to the Multilateral Investment Guarantee Agency, International Finance Corporation, International Centre for the Settlement of Invest Disputments, International Development Association, and the International Bank for Reconstruction and Development. These separate but intertwined members all conduct different operations but are all centered

around the World Trade Organization and World Bank's intent and goals. Obviously these goals include profit and have to allow for the members of the United Nations to flourish around the globe. This begs the question on how much influence private corporations have within the United Nations Specialized Agencies, but the World Bank and World Trade Organization specifically. The simple answer is that the private sector of business possesses a significant amount of influence in determining these organizations policies and agenda. My presentation will be centered around addressing the specific actions that these agencies take using past and current examples. This will highlight the profit and security these agencies and the private sector will provide each other during their endeavors in underdeveloped economic countries by investment. The research that I will present will be focused strictly on the World Trade Organization and World Bank. But, the outcome and findings of this research will illustrate the significance private corporations have within governments and government agencies in a world of globalization.

205. **The Effective Marketing of Products, Services, and Events towards College Students**

Submission Type: Poster
Submission Category: Business

Author(s):
Noah Moring, Undergraduate

Faculty Mentor:
Stefano Tijerina

Abstract:
Many companies exploit young people and their lack of control to turn them into easy customers that are willing to spend money they don't have. I know this is true for myself and I was sure it was true for others. I wanted to know just what it was that companies did to draw in such easy customers and also why these advertisements/marketing methods are so effective. In my research I focus on the strategies used by the private sector to target "Generation Z" consumers. I also conducted a survey within the student population of the University of Maine to determine if these strategies truly worked on students within my local demographic. My ultimate goal is to provide people in my generation the ability to identify how they are targeted by the world of marketing and social media.

Education

Projects 301 - 305

Education

301. **The Co-Parent Co-Op**

Submission Type: Poster
Submission Category: Education

Author(s):
Emmaline Richardson, Undergraduate

Faculty Mentor:
Daniel Puhlman

Abstract:
This project focuses on coparenting, a relatively new area of family studies which focuses on how two adults share the responsibility and care of a mutual child. While some parents are able to successfully navigate challenges, such as conflict resolution, others require the assistance of outside resources to help them along the way. The Co-Parent Co-Op is a digital app which will use machine learning technology to learn about parents and how they interact, ultimately teaching them healthy communication and team parenting strategies. While there are similar applications which are already available, none of these options offer a therapeutic intervention; rather, they are a collection of tools, such as a calendar and message board, which make coparenting easier for parents who already have the basic skills to do so. A form of "virtual therapy," the Co-Parent Co-Op would have a profound impact on rural communities, especially those in Maine, where divorce rates are high and parents are geographically isolated from therapists or counselors. Three groups stand to benefit from this program; first, family court cases will be resolved more faster and with fewer litigations, thus alleviating pressure on the legal system; second, therapists and counselors who offer the app will be able to gain greater insight into their client's concerns and dynamics related to their parenting and communication; third, children will positively adapt and adjust to their new family structure faster and more effectively. In conclusion, the Co-Parent Co-Op will offer Maine parents a cost-effective and therapeutic intervention to improve their relationship.

302. **The Perceptions of Coparenting According to Parents**

Submission Type: Poster
Submission Category: Education

Author(s):
Taylor Corey, Undergraduate
Kittiya Reeves
Emma Richardson
Sara Hunt

Faculty Mentor:
Daniel Puhlman

Abstract:
When a child is brought into a family, the couples must adapt to this change. Parents develop a coparenting relationship in order to raise and provide for the child(ren). The coparenting relationship is an integral part of raising children in families where 2 or more parents or parental figures are involved. The current study focused on how parents define the coparenting relationship. At the time of this proposal, the sample included 9 parents residing in a small, New England town. All participants had at least one child at the time of the interviews and shared the responsibility with a coparenting partner. This study focused on responses to three specific questions: How would you describe coparenting? What are some qualities of good and bad coparenting? And how would you describe your coparenting relationship with your child's other parent? The research team, which included 4 members, analyzed the questions using a grounded theory methodology. In conclusion, there were five significant themes parents identified. The significant themes found were the Default Parent, Implicit vs. Explicit, Communication, Default Parenting, Boundaries, and Support/Relationship. While the findings are consistent with the literature, it provides a greater depth as to how parents themselves experience and define the coparenting relationship. Specifically, the idea of default parenting is a concept that is not defined in the literature and further understanding is important.

303. **K-12 Engineering Research Across Education Fields: A Systematic Literature Review**

Submission Type: Poster
Submission Category: Education

Author(s):
Ethan Geheb, Graduate Student

Faculty Mentor:
Asli Sezen-Barrie

Abstract:
The purpose of this research is to provide a systematic review of K-12 engineering education research published between 2009 and 2018 across the education research field. Previous systematic reviews focused on narrower subtopics within engineering education, looking across shorter timespans. This study compares publications in engineering education journals to other STEM-related educational research journals, in order to understand the epistemic practices of these research communities in their approach toward conducting engineering education research. The topics, populations, and methods utilized within a collection of 117 research articles were coded using qualitative content analysis. The findings within both sets of journals indicate an increased publication of engineering education research articles. Within engineering education research journals, the most frequent topics of study were student content knowledge related to STEM topics, application of science and engineering practices, and impact of engineering design process activities on student learning. For other education research journals, the most frequent topics of study were investigating equitable & inclusive practices of engineering activities, teacher professional development of various engineering topics, and student content knowledge related to STEM topics. Across all education research fields, qualitative methods are used more often compared to quantitative or mixed methods. In addition, there seems to be a greater focus on student populations compared to teachers, with specific interest in secondary school populations. Overall, engineering education journals seem to focus more on research about student experiences of doing engineering and development of engineering practices. Publications in other education journals focus on the integration of engineering into classrooms and its effects on student learning outcomes. Implications of the findings and future direction are discussed.

304. **The Effects of Screen Time on Children**

Submission Type: Poster
Submission Category: Education

Author(s):
Shasta Minery, Graduate Student

Faculty Mentor:
Elizabeth DePoy

Abstract:
Research on school-aged children and screen time usage shows concern that screen-time may have a negative impact on children's overall mental health. Youth today are growing up engrossed in screens, consuming content such as streamed media, social and interactive media, stationary and active video games, and highly immersive virtual reality. Literature is replete with

warnings about screen time replacing activity critical to learning including physical activity, hands-on exploration and face-to-face social interactions. Research also shows that screen time could affect sleep duration and quality as well as emotional development and outcome and may even have both short and long-term effects on emotional development including an increase in aggressive behaviors and thoughts, desensitization to violence, and a decrease of empathy for others. According to recent studies, high amounts of screen time are associated with a child's irritability, low mood and cognitive and socioemotional development which can all lead to poor educational performance. Based on this literature, parent belief is crucial to ascertain in that parents may control screen time. Using survey methods, this study answers the questions: What is the acceptable daily amount of screen time reported by parents? What do parents/guardians report as the positive effects of children having adequate screen-time? What do parents/guardians report as the negative effects of their children having too much screen time? Results will be used to develop awareness and education for parents.

305. **The Effects of Screen Time on Children**

Submission Type: Oral Presentation
Submission Category: Education

Author(s):
Eliza Jacobs, Graduate Student
Laura Millay
Susan McKay

Faculty Mentor:
Susan McKay

Abstract:
The Maine Center for Research in STEM Education's STEM+C project is a research-practice partnership to develop an evidence-guided model to integrate computer science into middle school science instruction in Maine's school districts. This partnership has planned, piloted and begun to study modules designed through collaborations between middle school teachers and University faculty to integrate computer science into life, Earth, and physical science. A question which has guided the development of this project is: What pedagogical environments and learning strategies are needed for developing computing skills within the context of specific STEM disciplines? Answering this question includes exploring how to leverage the strengths of the research-practice partnership to support integration, including working toward shared understandings of computer science content. This presentation will share from a review of existing literature on supporting inquiry-oriented computer science pedagogy through

professional learning communities, with a focus on the importance of building trust and equity between researchers and practitioners. We will also share examples from our project of needs, challenges, and successes around these key issues of trust and equity. Data sources for our analysis include interviews with teachers and researchers, audio recordings of collaborative sessions, and analysis of the integrated modules created by the project.

Allied Health

Projects 401 - 424

Allied Health

401. **Complex Communication Needs and Augmentative and Alternative Communication: A Factor Analysis of Success in Children**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Abigail Hartwell, Undergraduate
Courtney Daigle
Amanda Thayer
Kalee Mclaughlin
Lauren Eastham

Faculty Mentor:
Nancy Hall

Abstract:
The purpose of the literature review and proposed study is to explore the factors that contribute to the success of children with complex communication needs who use augmentative and alternative communication (AAC). An extensive literature search was conducted via databases such as CINAHL, EBSCO, OneSearch and PubMed. To be included in the literature review, the studies had to be peer reviewed, centered around children with complex communication needs and AAC devices, and their success. It was found that factors related to individual's success were effectiveness of communication, child and device compatibility, child development, academic success, family and community involvement, and participation in everyday life. These findings indicate the multidimensionality of factors that intertwine to contribute to a child's success and the importance of outside support systems.

402. **Improving Quality of Life for Patients with Alzheimer's: Nutrition, Medication, Physical Activity, Music Therapy, and Speech Therapy Services**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Paula Crucianelli, Undergraduate
Emma Cristan

Celine Bolduc
MacKenzie Hunt
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Faculty Mentor:
Nancy Hall

Abstract:
Individuals diagnosed with Alzheimer's Disease (AD) are confronted by multiple changes and difficulties during activities of daily living (ADLs). The majority of people in long-term care have dementia (Brush & Camp, 1998). The number of dementia cases will continue to increase due to Baby Boomers aging (Maust, Bonar, Ilgen, Blow, & Kales, 2016). Research indicates that nutrition, medication, physical activity, music therapy, and Speech-Language Pathology (SLP) services positively affect AD patients with mild to moderate severity. Effects of these interventions may vary between patients. Positive effects may increase appetite, improve sleep quality, decrease agitation (Suryadevara, Bruijnzeel, Nuthi, Jagnarine, Tandon, & Bruijnzeel, 2017), along with improve the efficiency in which working memory is used (Campbell, & Marsh, 2018). More positive effects may be the improvement of expression, socialization, anxiety, depression, irritability, social isolation, awareness of surroundings, and physical health (Collingwood, 2017). The objective of this research review is to examine the impact of the combination of these interventions on the quality of life in patients with AD.

403. **Tone of Voice in Mothers with Postpartum Depression: Effects on Language Development**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Ashley Marie Chiassoni, Undergraduate
Shannon Dowd
Sydney Howell
Samiera MacMullen
Kailey Richards

Faculty Mentor:
Nancy Hall

Abstract:
Mothers may experience postpartum depression (PPD) after giving birth to a child which has been shown to lead to cognitive, emotional and behavioral deficits in their children. The purpose of this research identifies how PPD can affect a child's language development due to a change in the mother-child dyad interaction styles and bond. More specifically, this research study focuses on how the mother's tone of voice may affect the language development of their child. Specific research about the effects of PPD on language development in relation to tone of voice is lacking, which is why the researchers of this study are suggesting that this research be completed. Proposed is research examining mothers who have and who do not have PPD be conducted. They will be asked to record their verbal interactions between themselves and their child and these interactions will later be examined by looking at the mothers tone of voice to address any differences between the tone of voice used by a mother who has PPD and a mother who does not. Determining these potential differences will further emphasize the effects of PPD on a child's language development.

404. **Cultural and Linguistic Diversity in Speech-Language Pathology: Effectiveness of Treatment for Bilingual Clients with Speech Sound Disorders**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Molly Bayer, Undergraduate
Allison Adaschik
Meg Guly
Sarah Mitchell
Emma Turlo

Faculty Mentor:
Nancy Hall

Abstract:
As bilingualism in the United States continues to grow due to steady immigration from non-English speaking areas around the world, cultural and linguistic competence is a prominent aspect in the discipline of speech-language pathology. Speech-language pathologists face considerable challenges in their efforts to be culturally competent and to provide the most effective assessment and treatment for their expanding culturally and linguistically diverse clientele due to language mismatches between SLPs and their clients, a lack of research, and individual variability among clients. The current literature review outlines studies that examine

the lack of standard assessment and treatment guidelines when working with bilingual clients with speech sound disorders, and the results of smaller studies that explore localized treatment practices in geographical areas with high linguistic diversity. The resulting consensus indicates the importance of assessing and treating these individuals in all of the languages they speak, but this can be difficult to do when clinicians don't speak those same languages. The proposed research study explores the effectiveness of treatment of bilingual children with SSDs by monolingual clinicians. The quality of each group's individual treatment sessions, and the overall treatment outcomes of each group, will then be examined and compared to see if bilingual children achieve better outcomes when treated by a bilingual SLP.

405. **The Use of Smartphone Apps as a Supplement to Transgender Voice and Communication Therapy**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Maura Philippone, Undergraduate

Faculty Mentor:
Nancy Hall

Abstract:
This university IRB-approved thesis study follows a case study research design and investigates the effectiveness of the app "Voice Analyst" as a supplement to transgender voice and communication therapy. It is hypothesized that the use of "Voice Analyst" outside the clinic will enable participants to make greater progress and to increase their ability to retain their progress. The participants are four transgender women who want to raise the pitch of their speaking voices. The participants are asked to record themselves reading "The Rainbow Passage," and their data are tracked in a spreadsheet. "The Rainbow Passage" is the standardized passage used for all tracked recordings in this study. The study includes 4 phases and spans 12 weeks. For the first phase, participants take 7 recordings during one week to provide a baseline. During weeks 2-4, participants attend therapy sessions, practice with "Voice Analyst," and submit weekly recordings. During weeks 5-8, they attend therapy, but do not use "Voice Analyst". For weeks 9-12, they continue with therapy and resume "Voice Analyst" use. Quantitative data on pitch and volume changes, as well as qualitative interview data regarding the participants' experience with the app are presented in tabular and graphic form. Trends observed and future directions are discussed.

406. **Social Stories in Higher Education and the Workfield**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Olivia Haggerty, Undergraduate
Molly Davee
Bailey Casino
Monica Hothman
Carolyn Magill

Faculty Mentor:
Nancy Hall

Abstract:
Social stories are an intervention used for individuals with autism spectrum disorder (ASD) who lack specific social skills to be comfortable in many social situations. Social Stories provide explicit information on how to act in a variety of social settings. The literature review conducted for this research suggests that Social Stories are a beneficial intervention for younger, school-age individuals. From the research gathered, there is an absence of information on the use of Social Stories for young adults transitioning into higher education and the work field. During these transitional periods, young adults with ASD still face the same challenges with social situations, but interventions may be limited and/or inaccessible. A proposed research study will explore how effective Social Stories may be as an intervention in this population.

407. **A Consideration of Different Models for Voice and Communication Therapy Treatments for Transgender Clients**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Aviana Coco, Undergraduate
Maura Philippone
Isabelle Simbari
Isabelle Simbari
Logan Rollins

Faculty Mentor:
Nancy Hall

Abstract:
This literature review examines transgender voice and communication service delivery models. The relationship between speaking voice and quality of life is discussed as it pertains to transgender individuals. An overview of individual, group, and hybrid service delivery models is provided. Research relevant to each model is included in the respective discussions. Common themes found in individual intervention techniques included focus on fundamental frequency, intonation, resonance, rate, breath support, and vocal hygiene. Group intervention techniques included a focus on community-building, improving client morale, and mitigating speech-related anxiety. Hybrid intervention techniques included elements from both individual interventions (e.g. focus on pitch, resonance, breath support, etc.) and group interventions (e.g. focus on community-building, reducing anxiety, etc.). Each model is evidenced as successful in meeting treatment goals. The research reviewed implicates that individual, group, and hybrid models of transgender communication therapy are all effective avenues for treatment.

408. **Case Study of a 22 year old football player with Achilles Tendon Rupture**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Jasmin Le, Undergraduate

Faculty Mentor:
Christopher Nightingale

Abstract:
The Achilles tendon is a tendon that attaches the gastrocnemius muscle to the calcaneus and allows you to plantar flex your foot. Without this tendon, it would be very difficult to perform everyday activities such as walking, running, or pushing on the gas pedal. Achilles tendon ruptures are most common in the older population due to the decreased pliability of the tendon; however, Achilles tendon ruptures can occur in any population. There is still a debate about whether operative or nonoperative treatment is best for the recovery and outcome of the patient. This case report focuses on a 22 -year-old male collegiate football player who sustained an Achilles tendon rupture. This patient received operative treatment on his Achilles tendon. He also received a guided rehabilitation program from a team physical therapist. This study focuses on his recovery and the patient’s outcome.

409. **Deficits of mild TBI in young adults & adolescents: Integration of Speech-Language Pathologists into concussion management plans**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Katharine Libby, Undergraduate
Kaitlyn MacNeil
Molly Brown
Alyssa Simonds
Sophia Palangas

Faculty Mentor:
Nancy Hall

Abstract:
Concussions are one of the most prevalent types of traumatic brain injury (TBI). Concussions are a form of mild TBI (mTBI) caused by a blow to the head or neck resulting in physical, behavioral, and cognitive symptoms. The present review examines the current state of research concerning concussion management protocol and the lack of a speech-language pathologist's (SLP) role in these plans. Given the complexity of concussion symptoms, an interdisciplinary team is needed for proper management. Speech-language pathologists are needed to assess the specific effects these symptoms have on language. This paper presents a systematic review of deficits found in young adults with mild TBIs, and the integration of speech-language pathologists into concussion management plans.

410. **Comparing the Effectiveness of SGDs and PECS for Social Communication in Children with Autism Spectrum Disorder**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Marielle E. Shaw, Undergraduate
Jessica A. Holz
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Madison N. Morneault
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Faculty Mentor:
Nancy Hall

Abstract:
Despite the fact that the Picture Exchange Communication System (PECS) and speech generating devices (SGD) are two of the most effective and frequently used Augmentative and Alternative Communication (AAC) interventions for supporting social communication skills in school-aged children with Autism Spectrum Disorder (ASD), there is an evident lack of evidence determining which of these AAC interventions is most advantageous. Combined with a growing prevalence of autism diagnoses among children in the United States, this lack of evidence demonstrates a need for further research directly comparing PECS to SGDs. Though some previous researchers have considered this (i.e., Boesch, Wendt, Subramanian & Hsu, 2013 and van der Meer et al., 2013), their studies have had small sample sizes, commenced for inadequate durations, and have yielded inconclusive results that could not be extrapolated. Thus, the purpose of this proposed research is to reinvestigate the comparative advantages of PECS and SGDs, without the same limitations of previous studies. This way, it can be definitively determined which of the two AAC interventions--PECS or SGD--is superior when used to build social communication skills in school-aged children with ASD. A matched-pairs, six-year longitudinal study is proposed with a sample size nearly 10 times as large as those of previous studies. The research will assess and contrast both PECS and SGDs in terms of both efficacy and usability, as determined by both quantitative and qualitative measures.Concussions are one of the most prevalent types of traumatic brain injury (TBI). Concussions are a form of mild TBI (mTBI) caused by a blow to the head or neck resulting in physical, behavioral, and cognitive symptoms. The present review examines the current state of research concerning concussion management protocol and the lack of a speech-language pathologist's (SLP) role in these plans. Given the complexity of concussion symptoms, an interdisciplinary team is needed for proper management. Speech-language pathologists are needed to assess the specific effects these symptoms have on language. This paper presents a systematic review of deficits found in young adults with mild TBIs, and the integration of speech-language pathologists into concussion management plans.

411. **Assessing Health Related Quality of Life, Language Impairment, And Psychosocial Factors in Post-Stroke Aphasia**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Sophia Palangas, Undergraduate

Faculty Mentor:
Christopher Grindrod

Abstract:
Aphasia, an impairment of language comprehension and production typically due to an acquired brain injury or stroke, has been shown to negatively impact an individual's quality of life (Hilari, Needle, & Harrison, 2012). It has also been shown that people with aphasia (PWA) have an increased risk of developing depression (Kauhanen et al., 2000). There are few current assessments or screening tools which focus on depression in aphasia and the relationship between mood disorders and prognosis for language recovery. This type of screening tool is critical in order to identify a PWA's susceptibility for depression because depression elongates and/or prevents language recovery (Hackett & Anderson, 2005). In order to develop a more patient-centered quality of life screening measure, a focus group was conducted with PWA. Participants were asked questions on their health-related quality of life based on physical, psychosocial and language impairment influences, and shared their opinions on what most impacted their quality of life post-stroke. Responses were then transcribed and analyzed to find the most common issues in PWA. Based on this information, questions were developed and implemented as part of a brief quality of life screening tool specific to stroke survivors with aphasia. It is hoped that this screening tool will be used by speech-language pathologists to refer stroke survivors with aphasia to the correct mental health services as early as possible in the recovery process.
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412. **Idiom Comprehension in Adults With and Without Reading Comprehension Difficulties**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Molly Brown, Undergraduate

Faculty Mentor:
Christopher Grindrod

Abstract:
Figurative language, also known as nonliteral language, is the use of words in a way that deviates from their intended or literal meaning. Idioms are a specific form of figurative language, where the words of the phrase are not reflective of the meaning of the idiom. For example, to tie the knot means to get married, which is different from the physical act of tying a knot in a string. A great deal of research has focused on idiom comprehension in children with reading difficulties, while few studies have examined this issue in adult struggling readers. Many of the skills needed to understand figurative language are developed as children and adolescents. However, the presence of a reading disorder may prevent full acquisition of these skills. Using the developmental literature as a model, the goal of the current study is to investigate if there is a relationship between reading ability in adults and these individuals' understanding of idioms. For this study, the Woodcock Reading Mastery Test III (WRMT-III; Woodcock, 2011) was used to assess reading comprehension. To test idiom comprehension, tasks from a previous study by Nippold and Taylor (2002) were adapted. Participants were presented with idioms both in context and in isolation and asked to select the correct meaning. Participants also rated the familiarity of the idioms. Results will be discussed in light of current theories on figurative language comprehension in adults.

413. **Comparing features on a dedicated speech generating device and a mobile technology device**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Haley Usilton, Undergraduate

Faculty Mentor:
Jennifer Seale

Abstract:
Augmentative and alternative communication (AAC) can supplement or replace oral speech communication (ASHA, 2019). AAC solutions range from high and low, to no technology. The object of AAC is to improve the lives of those with communication disabilities, by providing alternative modes through which to communicate. The goal when incorporating high technology AAC solutions is to become operationally competent as quickly as possible (Beukelman &

Mirenda, 2013). However, AAC devices entail high learning demands that can prove challenging and potentially lead to abandonment (Rackensperger et. al, 2005). Shifting trends in AAC service delivery model are moving away from a clinician guided process to a consumer driven approach as a result of mobile technology (Meder & Wegner, 2015). This poses important challenges to the AAC delivery model (Gosnell, et al., 2011). With these challenges, appropriate assessment procedures are needed to fit technologies to an individual (Beukelman & Mirenda, 2013). Mobile technologies have altered this process by eliminating the need for device referral, removing the expertise of the SLP. Understanding of differences between both technologies is warranted. The primary aim is to examine features of technologies and preference within identical conditions. Using mixed-methodology the current study addresses the following questions regarding two categories of hardware, dedicated device and mobile technology.

414. **Managing Adolescent Obesity in Rural Primary Care Settings: A Systematic Review**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Olivia A. Pelletier, Graduate

Faculty Mentor:
Mary Tedesco-Schneck

Abstract:
Childhood obesity is a growing global problem (Þórisdóttir et al., 2012) in the United States (Þórisdóttir et al., 2012). Children and adolescents who are obese have a higher incidence of poor health outcomes that include hypertension, hyperlipidemia, diabetes mellitus type 2 and other health issues compared to their counterparts of normal weight and BMI. Children and adolescents who are obese also have a higher likelihood (70%) of being overweight or obese as an adult, which may lead to premature death (CDC, 2016; Frost & Porterfield, 2012). Among all obese children and adolescents, those living in rural areas are disproportionately overweight or obese compared to their urban counterparts (Armstrong, Lim, & Janicke, 2015). Despite this increased incidence of obesity among children and adolescents residing in rural areas, there are limited numbers of weight management programs for this population (Jensen et al., 2019). There are few studies that focus on treating adolescent obesity in rural primary care settings (Johnson & Jonson, 2015).
The goal of this systematic review is to 1) identify unique challenges of treating adolescents in rural areas in the primary care setting and 2) to identify programs that have been successful in managing adolescent obesity in rural primary care setting.

415. **The Family Nurse Practitioner's Role in Preventing Unintended Pregnancies within the Primary Care Setting**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Karyn Howe, Graduate

Faculty Mentor:
Eileen Owen-Williams

Abstract:
Unintended pregnancies continue to result in an array of adverse consequences for women, families, communities and healthcare systems. Although there are many effective contraceptive methods available, a large number of unintended pregnancies still commonly occur due to multiple reasons, including lack of access and imperfect use or user error. Contraceptive methods which remove the potential for user error, such as Long-acting Reversible Contraceptives (LARCs), are effective in reducing the incidence of unintended pregnancies. Family Nurse Practitioners' (FNPs) pivotal role in preventative health care within primary care settings, provides an optimal opportunity for these licensed, independent health care providers to provide reliable contraception methods which meet the reproductive needs of their diverse patients. Insertion of LARCs is within the FNP's scope of practice. In an aim to promote the wellbeing of women, this paper will critically examine the FNP's role in identifying and removing barriers to highly reliable contraceptives.
Keywords: unintended pregnancies, primary care, mental health, family nurse practitioner, long-acting reversible contraceptives, policy, prevention

416. **Can Film Help Us Shift From Victim Blaming to Social Responsibility in Sex Trafficking**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Leslie Devine, Graduate

Faculty Mentor:
Elizabeth Depoy

Abstract:
Given the centrality of popular culture and film in 2020 in the U.S., examining the imagery and narrative that portrays the sex trade in contemporary films provides an important lens for investigating how such films both reflect and shape public perception. Literature suggests that film has not clearly differentiated prostitution and sex trafficking. Moreover, film critics have noticed that film often places "sex workers" in an empowered, but temporarily down-on-their-luck position, and as white women of a comparably equal socioeconomic standing their male customer. The extent to which empathy, consumerism, male privilege, and sociocultural exploitations are part of the symbolism have yet to be discovered. Scholarly film criticism remains to be done to verify these claims, to further examine what images and narrative are used, and how and what messages are reflected in them. Clearly myths can be reinforced by contemporary film. Movies can possess the ability to inform, to persuade, and to influence public opinion. This mixed method research is therefore being undertaken to examine popular contemporary films on sex workers released in the United States. The power and control wheel will be used as a coding scheme to answer questions that determine if and how film promotes or inhibits a cultural shift in responsibility from victim-blaming to social responsibility.
To allow a longitudinal analysis, this research will engage with films that have content on sex work that have been released within the last decade.

417. **Cardiovascular Disease in Geriatric Women**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Lindsey Desrosier, Graduate

Faculty Mentor:
Patricia Poirier

Abstract:
The overall purpose of this literature review is to demonstrate the importance of addressing cardiovascular disease in women, given the fact that cardiovascular disease is the number one cause of mortality of women in the United States. Focus is on evaluation of cardiovascular disease in women over 65 years of age living in rural communities, and measures that can be initiated in the primary care setting to ensure proper implementation of the 3 levels of prevention. The goal of the research is to minimize risk for cardiac-related morbidity and mortality in women. The research was conducted through evaluation and review of current literature to assess how patients should be managed in the primary care setting, in regard to

cardiovascular disease. Peer-reviewed journal articles were pulled primarily from CINAHL and Up to Date. Review of the literature revealed a significant amount of information on cardiovascular disease in women, however limited research on how to combat rural health disparities. Recommendations for future primary care practice include to: 1. Begin screening patients at the age of 18 years for hypertension and family history of cardiovascular disease, 2. Implement screening tools such as the ASCVD risk estimator application as soon as possible, 3. Educate patients about heart-healthy lifestyle and diet modifications throughout the lifespan, 4. Consult with specialty clinicians in the rural clinic setting in order to minimize health disparities for rural patients, and 5. Develop an awareness for atypical presentation of cardiovascular disease in women and provide patient education.

418. **Pain Management in the Older Adult**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Alessandra Guerin, Graduate

Faculty Mentor:
Patricia Poirier

Abstract:
The intent of this paper is to inform the reader of the importance of managing pain and anxiety in the elderly population. The aspect of aging can be fearful for the older adult, as it is inevitable that the body changes, and with change, can come pain and/or anxiety. It is important for the older adult to feel in control of aging and feel empowered to age well. It is of equal importance for the primary care provider to feel comfortable in managing pain and anxiety in the older adult. This paper will also address challenges associated with pain control of the elderly, such as provider attitudes and bias, including potential educational opportunities for primary care providers on this topic.
As the body ages, changes associated with the way one can process medications occurs. Additionally, this paper will discuss some of the physiological processes that occur as we age that aid in how pain perception becomes altered with age. This coupled with the differences in processing of medications makes managing pain with narcotics or managing anxiety with benzodiazepines difficult in those older than 65 years old. It is important that providers feel comfortable in prescribing to the older adult and this paper is aimed to educate on how to do so safely using the BEERS criteria, a case study, and will discuss other complementary and alternative modalities.

Keywords: Pain management, anxiety management, elderly, older adult, complementary and alternative medicine, BEERS criteria

419. **Volunteer Participation of Older Adults: A Comparison Between Volunteers in the Retired and Senior Volunteer Program and American Time Use Survey**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Rachel Coleman, Graduate

Faculty Mentor:
Jennifer Crittenden

Abstract:
Declining volunteer rates among older people as other activities compete for their time are a concern due to the benefits of volunteering for older people and their community. Primarily, these activities are caregiving for dependent family members and employment where personal interest or financial strain necessitates working until a later age. Identifying how these activities impact an older person's volunteering is critical for improving volunteer engagement.

To explore this, volunteers aged 55 and older were compared from the Retired and Senior Volunteer Program (RSVP) (n=1,139) and the broader volunteering population from the 2018 American Time Use Survey (ATUS) (n=328). Volunteer participation was analysed through regressions examining factors that may impact volunteer participation. Higher caregiving and working hours were expected to result in lower volunteering hours while RSVP volunteers were hypothesized to contribute more volunteer hours than ATUS volunteers.

The analysis found increases in annual household income predicted lower volunteer hours in both groups ($p < .05$). RSVP volunteer hours ($M = 37.5$) were also predicted by gender ($p < .05$) and caregiving hours ($p < .0001$); however, household income and gender both lost significance once working status and work hours were removed from the model. Conversely, ATUS volunteer hours ($M = 71.7$) were predicted by household income and the number of people in a household ($p < .05$). Implications of similarities and differences between RSVP and ATUS volunteer participation are important for effectively engaging and retaining older people in volunteer activities.

420. **A look at older adult volunteers: Volunteers with a caregiving role for their grandchildren**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Abbie Hartford, Graduate

Faculty Mentor:
Jennifer Crittenden

Abstract:
Intergenerational connections between grandparents and grandchildren are found to benefit both parties. For grandparents specifically, these connections provide improved cognitive ability, closer social supports, and an increase in health and quality of life. This poster presentation focuses on the comparison of older adult volunteers not caring for grandchildren and older adult volunteers with a caregiving role for their grandchildren. Analysis looked at how the role of caring for grandchildren impacts older adult volunteers.
This poster presentation will review quantitative and qualitative findings from a recent national survey of older adult RSVP volunteers. The original RSVP study looked at role conflict and the relationship it had to volunteer satisfaction and retention. In the study, of the 1,697 respondents, 21% of the respondents (n=356) reported having a caregiving role for their grandchildren. Analysis of participant responses revealed 83.1% of volunteers caring for grandchildren had a quality of life rating of 4 or higher, with 5 being the highest, versus 78.9% of volunteers not caring for grandchildren. Discussed in this poster presentation are the results of further analyses that demonstrate the health and well-being advantages of intergenerational contact and caregiving. Implications include the need to support and encourage intergenerational connections for older adult volunteers. Further, the importance of RSVP recognizing the benefits volunteers caring for grandchildren have is key in order to better promote and incorporate this role more often.

421. **Obstructive Sleep Apnea in Primary Care: Effective Screening and Treatment of Adult Patients**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Devon Malay, Graduate

Faculty Mentor:
Sean Sibley

Abstract:
Obstructive sleep apnea is the most common sleep-related breathing disorder within the general population, and has the highest prevalence rates in older men and post-menopausal women. The disorder has been linked to increased rates of treatment-resistant hypertension, atrial fibrillation, cardiovascular disease, insulin resistance, and an increased all-cause and cardiovascular mortality. Although the implications of untreated OSA have begun to be better understood, recognition of the importance of screening and treatment of the disorder in primary care remains lacking. A review of literature concerning OSA screening and treatment in primary care was performed, with emphasis placed on efficacy of existing screening tools and high risk populations. Recommendations for the family nurse practitioner regarding targeted populations for screening, assessment tools, treatments, and patient education were created to prioritize patients in the primary care setting who are at highest risk for OSA development and disorder sequelae.

422. **Analysis of Expressive Art Therapy in Children with Post Traumatic Stress Disorder**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Maranda Drouin, Graduate
Mariah Dufour

Faculty Mentor:
Elizabeth DePoy

Abstract:
“The term expressive arts refers to any combination of dance, writing, visual arts, drama, music or other creative outlets. Expressive arts therapy is taking these modalities and using them to enhance individual development and growth” (Benefits of Expressive Art Therapy for Children, 2016). The ultimate goal of Expressive Arts Therapy is to aid individuals in evolving their thoughts, feelings, and life experiences into a visual image or expressive product (Expressive Arts Therapy, 2015). Post Traumatic Stress Disorder is a common diagnosis for both children

and adults. When a child experiences a traumatic event such as physical, sexual or emotional abuse, they are more likely to have adverse developmental effects. Expressive Art Therapy is a commonly used evidence-based practice due to its ability to meet utilize children's "natural mode of communication (play) as a non-verbal narrative and symbolic language" which can increase the level of safety for a child working through trauma (Steele, Malchiodi 2012, pg. 52). Using interviews and observation this mixed-methods inquiry aims to gain insight, knowledge and develop theory as to how those who use expressive art therapy work with children with post-traumatic stress disorder.

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Steele, W., & Malchiodi, C. A. (2012). Trauma-informed practices with children and adolescents. New York: Routledge.

423. **A Study Examining Attitudes and Perceptions Towards Individuals with Visible Impairments**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Shelby Westman, Graduate
Batool Qweider

Faculty Mentor:
Elizabeth DePoy

Abstract:
Many have views about the ideal body image, and how it denotes human worth and health. Our cultural and social environments reinforce these expectations; placing standards of what it means to be attractive and viable. Therefore, it is not unusual to assume that people with physical impairments do not fit standards for human desirability. When individuals are viewed differently from what society deems as the norm, they may be treated as outsiders, characterized as weak, and unable to contribute to their communities. These views create societal barriers and limitations particularly for people with visible physical impairments. The Social Model of Disability affirms that persons are not "disabled" because of their medical status, impairments, or physical appearance rather, a person is "disabled" by societal stigma, negative attitudes, and

systemic exclusion towards individuals living with physical limitations. Researchers have examined the factors which influence people's attitudes, opinions, and what efforts can be taken to reframe societies' way of thinking and visuality is one that is critical. In our study we will test the relationship between physical appearance and visual stereotypes. As the basis for revealing the influence of appearance on human valuation and expectations, we ask respondents to tell life histories about the same child represented differently in two photos. Thematic analysis will be ongoing to analyze data and reveal theoretical tenets that are related to visual imagery and assessment of human worth.

424. **How Does Self-Care Correlate With Stress Levels Among MSW Students?**

Submission Type: Poster
Submission Category: Allied Health

Author(s):
Joshua Baker, Graduate
Spencer Desimone
Kayla Minkowsky

Faculty Mentor:
Elizabeth DePoy

Abstract:
According to Yusufov, Nicoloro-Santa Barbara, Grey, Moyer, and Lobel (2019), graduate students face a significant amount of stress, especially graduate students enrolled in programs such as medical, clinically focused, or other related programs. These students are not only responsible for managing demanding and challenging courses, but are also responsible for the care of the patients and clients they serve. Studies have found that graduate students often report low levels of confidence in their ability to effectively assist clients and complete tasks due to lack of knowledge and experience which in turn increases the chances that these students will experience high levels of stress and perceived stress. Research has indicated that individuals currently enrolled in educational programs are struggling with managing their stress at a much higher level than prior generations and are also exhibiting limited coping and self-care skills. In addition, there are many different ways that students experience stress. Perceived stress can arise from daily life, educational demands and an individual's ability to handle stressful situations. All of these attributes combined often increase the likelihood that graduate students will experience mental health conditions. Colleges and universities articulate the importance of self-care to students, but how many students actually engage in meaningful self-care routines that reduce their stress? This study aims to assess current Masters of Social Work students stress levels and

the amount of self-care in which they engage. We will be using two surveys; one will assess their perceived stress and the other will be about self-care.

Engineering and Information Sciences

Projects 501 - 548

Engineering and Information Sciences

501. **The Fractal Properties of Pascal's Triangle in Two Cases: Modulo 2 and Modulo 4**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Betelhem S. Abay, Undergraduate

Faculty Mentor:
Andre Khalil

Abstract:
The fractal properties of Pascal's triangle have been studied by mathematicians over the past several decades. N. Fine's work, published in 1947, on the properties of binomial coefficient modulo primes has proven critical to the construction of Pascal's triangle as a fractal. Evidence of this is found in the work of later mathematicians, such as Stephen Wolfram in 1984. Building on previous research, we will present two cases of Pascal's triangle that exhibit fractal properties. To start, we will show that Pascal's triangle modulo 2 contains self-similar patterns. Obtaining this result requires presenting an interesting theorem from number theory that dates to the late-nineteenth century. We will then map the triangle to a subset of the unit square, so that we may calculate its box-counting dimension, thereby allowing us to investigate its fractal properties. Little work has been published on cases modulo composite numbers. Motivated by visual patterns discovered using computer code, we will show that certain sub-regions of the modulo 4 case contain the modulo 2 case. The approach in this case relies on implementing the box-counting algorithm in the Python programming language.
The research has been crafted into a compact poster presentation summarizing the mathematical and computer science methods that were used. The results of the modulo 4 case are of particular interest, providing motivation for researchers to analyze other composite moduli that are built from primes.

502. **Exploration of Potential Correlation Between the Fractal Dimension of Microcalcification Clusters and Number of Disrupted Tissue Regions in Mammograms of Tumorous Breasts**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Matthew Ryckman, Undergraduate

Faculty Mentor:
Andre Khalil

Abstract:
Breast cancer is one of the most popular cancers affecting women all over the world. Mammography is a widely used breast screening technique and mammograms are mostly analyzed by radiologists. The use of computer-aided diagnosis (CAD) techniques as a computational assistant in breast image analysis is a field that still needs improvement but could enhance the efficiency of early cancer detection. Calcium deposits clustered in a non-defined shape, in particular, microcalcification clusters (MC) in breast tissue are one of the focus areas for radiological analysis of breast image. Previous studies at CompuMAINE Lab have used fractal geometry and identified that the benign MC has a fractal dimension, D = 1 or 2 and malignant MC has D value ~ 1.5. In another research, this same team has studied the quantification of breast tissue disruption using the Hurst exponent, H associating the range $0.45<H<0.55$ to disrupted tissue regions of the breast microenvironment. The aim of this research is to study the correlation between D values that distinguishes benign MC from malignant MC based on their geometry and H values used for the determination of roughness in regions of the breast tissue microenvironment. The outcome of this research would help in understanding the relationship between geometry in tumor growth to its loss of tissue homeostasis leading to disruption.

503. **Determining Bee Activity Types Using Doppler Radar**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Lily Bragg, Undergraduate

Faculty Mentor:
Nuri Emanetoglu

Abstract:
In recent years, honey bees have been disappearing at significant rates. Various methods can be used to monitor hives but these can be expensive, inefficient, or potentially harm the beehives. To avoid these problems, a Doppler radar system was previously developed to monitor the

overall hive activity. The system uses a root-mean-squared (RMS) power calculation to determine hive activity, which was determined previously to be proportional to the overall health of the hive. This measurement includes the forager bees' activity, as well as the hive's general activity. Forager bees leave the hive to collect pollen and nectar. By monitoring forager activity one can determine the colony's productivity in producing honey, and therefore the overall health of the hive. General activity refers to bees swarming, flying orientation flights, or non-forager activities. If the general activity decreases, this can indicate a weaker or sickened colony. Because the forager bees move faster, this activity corresponds to higher frequency signals than the general activity frequencies. With the previous measurement system, the general activity and forager activity were not measured separately- one RMS power calculation was made, reflecting overall activity. This project focused on separating the forager and general activity with two electronic filters, and then creating a printed circuit board (PCB) design for the filters and overall Doppler radar system. This was done because the ratio of forager to general activity may be able to predict future hive behaviors, such as bees attempting to permanently leave the hive, but further research is needed to confirm this.

504. **Design and Fabrication of a Lower-Limb Biofeedback Device**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jacob Girgis, Undergraduate

Faculty Mentor:
Babak Hejrati

Abstract:
In older adults, over time, gait abnormalities can lead to limitations in mobility, which are associated with loss of independence, substantially reduced quality of life, increased fall risk, and even hospitalization. Traditionally, patients would go to physical therapists to receive feedback for and training on their gait. However, with wireless sensors and embedded computers becoming more affordable, instead of having to go to a physical therapist, it is now possible to analyze the individual's gait and give feedback accordingly using wearable and completely portable systems.

As a means of giving feedback, we have designed a wearable apparatus that consists of 6 "haptic units" placed on 3 sides of each thigh. Each unit consists of a symmetric formation of three low-cost coin motors to trigger in the event of improper gait behavior. To give the user the freedom

to walk without any constraints while wearing the device, the vibrotactile units on the thighs are connected to a Raspberry Pi 4 placed in a waist bag worn by the subject. To find the best pattern in terms of the likelihood of the user perceiving the feedback, we conducted experiments with different conditions for the number of pulses that the user receives from the vibrotactile unit and with the subjects walking at different speeds. As the final goal of this project, by using this device in tandem with inertial measurement units (IMUs) placed on the user, we will be able to offer real-time feedback for correcting and optimizing the gait of the subject.

505. **Hyper-spectral Data Analysis**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Isaac Fair, Undergraduate
Aiden Lammert
Samuel Beaudoin
Matthew Prescott
Noah Monto

Faculty Mentor:
Terry Yoo

Abstract:
Maine is composed of large natural landscapes and vast amounts of agriculture. As such, the residents of Maine rely on natural resources for daily life. For farmers and foresters, who must oversee hundreds of acres of land, it can often be difficult to effectively all of it. Effectively managing the land on foot is impossible, and therefore many issues can go unnoticed.
A healthy plant gives off a different spectrum of light than an unhealthy plan that a human eye is unable to discern. Using high tech scanners with the ability to scan a broad amount of the light spectrum, it is now possible to gather information about the health of a plant that a human may not be able to determine otherwise. Combining this with advanced drone technology, these specialized cameras can be used to quickly gather information about acres of land.
Our software, LEAF (Light Emission Analysis of Foliage), transforms these drone images into color-coded maps displaying information of the plant life. Some example applications of this include: helping farmers gain information about the health of their crops, allowing researchers to track the spread of pests, and allowing landowners to receive maps that show what plants and features make up their land.

Our goal for LEAF is to make it easier for landowners, farmers, foresters, and the curious to identify and treat issues on their property.

506. **ICESat 2 GUI for Lightweight Offline Operations**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jacob Boudreau, Undergraduate
Joshua Schaff
Adam Smith
Adam Green
Eli Legere

Faculty Mentor:
Terry Yoo

Abstract:
The IceSat-2 satellite was launched on September 15th, 2018. The satellite's mission is to measure glacier, sea ice, and vegetation height information. Currently, the data can only be accessed online. Also, scientists currently must perform analysis on this data themselves. IGLOO aims to fix both of these problems. Oftentimes, scientists will want to access data while in the field which is currently not possible, so users will be able to download data for offline use. This application will also allow users to perform analysis on the data they have downloaded. The target audience for the application is climate scientists, which have varying levels of programming experience. IGLOO requires little to no programming experience to perform common analysis. More advanced users will be able to create their own functions, which will allow users to perform any operation they need.
This is a capstone project for the COS 397,497 Capstone class taught by Terry Yoo. This project was commissioned by Seth Campell, Kristen Schild from the climate science laboratory.

507. **Silicon Carbide Nanowires and Thin Films for Sensing Strain and Pressure in Harsh Environments**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Hua Lin, Undergraduate

Faculty Mentor:
Sheila Edalatpour

Abstract:
The existence of a large piezoresistive effect in bulk and low-dimensional silicon-carbide structures is tested. The effect can be used to fabricate sensors that are able to measure pressure, temperature, and mechanical strain in harsh environments. Conventional silicon-based sensors cannot be used in high temperature, high shock environments as the piezoresistive effect for silicon reduces significantly for temperatures above 150°C. However, silicon carbide is a promising candidate as it is more chemically stable and has great electrical and mechanical properties. The piezoresistive effect can be characterized by a change in resistivity of the material when a strain is induced. However, since the piezoresistive effect is relatively low for bulk silicon carbide, we propose to analyze the sensing capabilities of silicon carbide nanowires, as these low-dimensional structures have the possibility to increase the gauge factor, and hence, the sensitivity. First-principle methods are utilized to observe the changes in resistivity by analyzing the band gap of the material under various strains. The changes in the band gap relate directly to changes in resistivity, due to the semiconducting nature of silicon-carbide. Density Functional Theory is used to computationally generate the band structures and the band gaps are plotted against relative deformations (uniaxial strain). Quantum Espresso is employed to perform the DFT calculations, which reveal that the band gap varies linearly with deformation across a certain operating range. Further analysis includes characterizing the sensitivity of the low-dimensional silicon carbide and comparing with the analysis of the bulk material.

508. **Humanoid Robot Simulator of Torso and Arm For The Testing of Wearable Robotics**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Sean Detwiler, Undergraduate

Faculty Mentor:
Babak Hejrati

Abstract:
As research can sometimes be dangerous for a human subject, approval for the use of human subjects can be a challenge to receive. For this reason, a humanoid arm simulator was desired for the testing of wearable robotics in the Biorobotics and Biomechanics Lab. The robotic arm was to be designed for the testing of joist assistive devices of the shoulder, elbow, and fingers. The robot should be able to mimic the arm swing of a walking person, hold onto an object with the hand, and move the forearm with the bicep. The humanoid simulator was designed using the open source 3D printable robot InMoov. Using the designs of Gael Langevin and a 3D printer the shell of a robotic arm could be constructed. After removing potentiometers from the inside of servos and redesigning a mounting method of the torso to the table, a robot was constructed. The robotic control mechanism was created using a graphical user interface (GUI) on MATLAB. The main purpose of the robot was to create an arm like a human subject's arm. To compare the two, the robot and designer's joint positions and angles were measured using motion capture and were compared. The robot resulted in very similar extension and flexion of the shoulder and fingers to the human; however, the max angle of abduction/adduction of the shoulder and extension/flexion of the bicep for the robot were less than that of the subject. This is likely an area of improvement for future work.

509. **Climate Reanalyzer Mobile**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Isaac Tremblay, Undergraduate
Enoch Lin
Kody Moseley
Taidgh Robinson

Faculty Mentor:
Terry Yoo

Abstract:
Climate change is an incredibly important issue of our time. Climate change is often angled as a political issue but climate data from things like weather stations is valuable to a host of people and important regardless of political affiliation or academic standing. This fact means that there is a need for computer applications which provide this data in a way that is easy to use, view, and understand. Climate Reanalzyer, one of the best websites for visualizing climate data, is run by Dr. Sean Birkel at the Climate Change Institute here at the University of Maine. In an effort to

make the Climate Reanalyzer project more accessible, Dr. Birkel has tasked our computer science capstone team, Runtime Terror, with designing and building a cross-platform mobile app with many of the features of the Climate Reanalyzer website. Runtime Terror consists of four senior computer science students: Enoch Lin, Kody Moseley, Taidgh Robinson, and Isaac Tremblay. We all have experience in mobile development and are interested in earth science and climate change. Our project, Climate Reanalzyer Mobile, is the culmination of two semesters of hard work. Our first semester was spent identifying the most important requirements for the app, how it should be designed, and what it should look like. Then during our second semester we programmed the app and tested it thoroughly. The result is a functioning cross-platform mobile application that brings several of the most popular parts of Climate Reanalyzer to mobile, and also has some unique features only available on mobile.

510. **Deep Network Compression using Activation-Based Information Scores**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Dawsin Blanchard, Undergraduate

Faculty Mentor:
Salimeh Yasaei Sekeh

Abstract:
The advent of machine learning, and particularly the technique of deep learning, has allowed us to solve incredibly complex real world problems, such as computer vision or autonomous driving, for which traditional algorithms are infeasible to develop. As deep neural networks continue to become increasingly advanced, our ability to solve these problems expands. This however, comes at a cost of both increased memory consumption and computational requirements. In this work, we focus on convolutional neural networks (CNNs), a popular network architecture where state-of-the-art networks have upwards of tens of millions of parameters. These intense requirements pose a barrier especially to lesser powered machines such as phones or embedded devices. However, through network compression we can reduce both the amount of memory usage and FLOPs required while retaining accuracy.

This paper offers an improvement on the current state-of-the-art algorithm for deep network compression, MINT (Ganesh, Corso, and Sekeh (2020)), which uses the technique of pruning to compress the network. Previous methods used weight based measures to determine neuron importance and select which filters to prune, however MINT took a new approach instead using

conditional mutual information. We propose a novel algorithm which achieves higher pruning percentage by combining the techniques of previous weight based techniques and MINT. Through this combination we are able to improve the detail of our neuron importance measures, and thus pruning percentage. We validate our proposed technique through several experiments on well known CNN architectures such as VGGNet and ResNet using the MNIST and CIFAR-10 data sets.

511. **The Applications of Edge Detection to the Tissue Segmentation of Greyscale Mammograms**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Basel White, Undergraduate

Faculty Mentor:
Andre Khalil

Abstract:
As part of a first of its kind longitudinal breast cancer study, there are thousands of mammograms that need to be analyzed computationally. However, each mammogram needs to be converted into a binary (black or white) spatial representation in order to delineate breast tissue from the pectoral muscle and image background, which is called a mammographic mask. Due to this subtle delineation marking the transition between breast tissue and pectoral muscle, the current methodology for completing this task is for a lab member to manually trace the outline of the breast.. The time cost for completing this action would be three minutes for each of the thousands of mammograms, which vary on the number of patients and frequency of received mammograms. Thus, an automated pectoral muscle segmentation algorithm is proposed through the adaptation of a multi-scale wavelet-based edge detection previously developed and used by CompuMAINE in cell biology and satellite imagery. Using an in-house software, an automated pectoral masking algorithm was created through the development of a script to utilize Gaussian and Mexican Wavelet Transform methods to identify potential maxima chains. The most efficient chain was chosen due to its fit over the pectoral muscle and various features of the maxima chain. To then automatically create the mask, the candidate chain is overlaid onto the original grey scale mammogram upon which the tissue is segmented, and the binary mask is created. The efficiency of this automated method is measured quantitatively through the use of relevant spatial metrics and statistical analyses.

512. **Finite Element Process Simulation of Additively Manufactured Shelter Replacement Parts**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Nicholas Jacobs, Undergraduate

Faculty Mentor:
Scott Tomlinson

Abstract:
Additve Maufacturing (AM) has the potential to reduce the cost, environmental impact, and logistics of manufacturing replacement parts for the U.S. Army. Finite element process simulation of extrusion deposition AM has the potential to reduce build failures, improve overall part performance, and reduce costs. Process simulation of extrusion deposition AM allows for design process optimization of: print geometry, print toolpaths, and machine settings. It does this by using the cumulative information from each step in the design process to determine the effects of the AM process on the final part. AM simulation also has the potential to streamline the machine calibration process. This research will evaluate the following commercial finite element packages which utilize progressive voxel element activation to model extrusion deposition AM: Genoa 3DP by AlphaSTAR, 3DEXPERIENCE Additive Manufacturing – Print to Perform by Dassault Systèmes, and Digimat-AM from e-Xstream. These software packages will be tested to study how they can model physical prints. Their ability to model thermal history will be evaluated first as the thermal history of a part governs aspects of the print including: polymer crystallization, thermoviscoelastic behavior, material shrinkage, and the development of residual strains. Simulation software will be particularly valuable in future development of replacement parts. Replacement parts developed by the University of Maine Advanced Structures and Composites Center that will be considered for finite element process simulation include: a HMMWV bracket; ISO Shelter door handle; folding step; leveling jack baseplate; panel latch; and Airbeam tent insulation toggle.

513. **Mechanization of Origami-Inspired Rapidly Deployable Structures**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jordan J. Duffy, Undergraduate

Faculty Mentor:
Masoud Rais-Rohani

Abstract:
The goal of this research is to explore the mechanization of rapidly deployable origami shelters for use in the field as temporary shelters. Origami-inspired design is a growing field with numerous engineering applications. The folding patterns of the panels allow for a compact, and mobile shelter. For ease of use, and rapid deployment, it is crucial to have these shelters self-erect in an efficient and timely manner. An overview of potential power sources and their respective applicable mechanisms, is down selected to arrive at an ideal mechanization solution. An analysis model is developed to determine the loads required to erect a shelter with representative sandwich panels. Considerations are taken to ensure the final mechanism does not interfere with the fully erect shelters internal space, such as hiding within the shelters panels. A variety of kinematically compliant mechanisms are contemplated, and iterated on to determine the best solution to erect the Origami 3R2T5TR shelter. Due to the specific geometry of the shelter, a simple fixed end actuator could not erect the shelter and instead a two bar system on a curvilinear slider with an actuator was required for the complex motion.

514. **Rapidly-Deployable Shelter Systems**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Joshua Clark, Undergraduate

Faculty Mentor:
Scott Tomlinson

Abstract:
The Advanced Structures and Composites Center (ASCC) has been working on multiple rapidly deployable shelter systems under a contract with the U.S. Army Combat Capabilities Development Command Soldier Center in Natick, Massachusetts. This work has included the development of three shelter concepts: the origami-inspired folding expandable-shelter, thick foldable structure/floor, and the self-erecting/rigidizing shelter.

An origami-inspired shelter is made of rigid panels connected by multiple hinge lines. The ASCC has designed and analyzed multiple origami-inspired shelters. In this research, the ASCC is now working on fabricating a nominal-scale origami inspired shelter using thermoplastic composite materials. In order to accomplish this goal, the team is building several representative models to verify the folding process and to ensure that the composite panels and hinges will provide the desired functionality.

The thick foldable structure/floor is a system in which the walls of a delivery system fold down and become the floor for the final structure. A model of the thick foldable structure/floor was built in the past year using the hinge and structure concepts that the ASCC designed. The research presented here includes work for this structure that includes creating a model of the structure using composite panels and thermoplastic hinges as well as designing a pop-up shelter that opens up from the inside of the thick foldable structure/floor upon deployment.

The self-erecting/rigidizing (SER) shelter is a rapidly deployable soft-wall shelter. Currently the ASCC has constructed a SER shelter using continuous poles and fabric. This research presents the ASCC work to improve this shelter by incorporating inflatable ridge poles on the roof fabric and replacing the continuous poles with segmented, 3D-printed poles.
This material is based upon work supported by the CCDC Soldier Center under Contract No W911QY-18-C-0101.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the CCDC Soldier Center.

515. **SeiDart**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Nathan Gazey, Undergraduate
Jens Hansen
Adam Farrington
Alex Thatcher

Faculty Mentor:
Terry Yoo

Abstract:
The simulation of seismic and radar investigations of icebergs is a powerful learning tool for students first learning how to read scientific findings and how materials react to a seismic or radar source. Dr. Christopher Gerbi has addressed this problem with software called the Seismic and Radar Toolkit (SeiDarT), but is difficult to learn and operate due to its complicated installation instructions and dependence on command line inputs. The purpose of our work is to build upon the existing software in order to make the SeiDarT software more approachable. To do this, we have been tasked with the creation of a graphical user interface (GUI). This project has been undertaken since the Fall of 2019, and has been produced by a team of four undergraduate students over the course of the last two semesters. The initial beta release of the product is soon to be ready, and plans are being made to run a beta test among the students of the School of Earth and Climate Sciences under the watch of Dr. Christopher Gerbi. Our GUI is set to be released in May of 2020, making the visualization of seismic and radar simulation accessible to researchers and students in the field around the world.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the CCDC Soldier Center.

516. **Visualizing the Spatio-Temporal Evolution of Camps and Ghettos During the Holocaust**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Aubree Nygaard, Undergraduate
JMaja Kruse
Sanonda Datta Gupta

Faculty Mentor:
Penny Rheingans

Abstract:
Advancements in technology have opened the door for imagining the past in new ways. Visualization allows us to gain new insights about significant world events such as the Holocaust. Previous work has been done developing geographical methods to study the Holocaust, particularly mapping historical datasets with GIS. However, there are many historical and geographical questions about the Holocaust left to be explored through visualization. Specifically, we seek to understand the spatio-temporal evolution of the major concentration

camps and their subcamps with ghettos. We make use of three datasets: a dataset of concentration camps and their subcamps, a dataset of ghettos, and a dataset of boundary changes throughout World War II. With our visualizations, we wish to address questions about the timing of opening and closing dates of camps and ghettos, territory changes during the establishment of camps and ghettos, the types of labor that took place in camps and ghettos, and the mass murder events that took place in ghettos. We use GIS as well as other technologies to create our visualizations. Our visualizations will be used as an educational and presentation tool to allow viewers to gain a more complex understanding of the Holocaust, as well as a resource to potentially spark new research questions.

517. **Determining the Mechanical and Thermal Properties of Sintered Lunar Regolith using Concentrated Sunlight**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Angel Loredo, Undergraduate

Faculty Mentor:
Justin Lapp

Abstract:
In the epoch of space exploration, technological improvements in space travel have led to recent interests to construct settlements on the Moon. Oxygen, a vital resource for spacecraft fuel and breathable air, can be harvested by reacting lunar regolith. The vast abundance of lunar regolith and its durability has prompted interest to be used for construction material. This research explores the effects of grain sizes to determine the mechanical and thermal properties of concentrated- sunlight- sintered lunar regolith. Understanding the strengths and thermal capacities of lunar regolith will aid in the development of permanent lunar settlements with breathable air.

518. **Design and Construction of a Computer Controlled Astronomical Spectropolarimeter**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jacob Marchio, Undergraduate

Faculty Mentor:
Sam Hess

Abstract:
Spectroscopy is one of the main ways information about astronomical objects is obtained. A spectrograph takes the light and spreads its frequencies spatially so it can be recorded with a sensor. In addition to the spectroscopic information, the polarization state of the light can also be examined, and when both are done within the same instrument the result is a spectropolarimeter. A spectropolarimeter can detect wavelength dependence to polarization. Astronomical polarization effects can come from magnetic fields of stars, or from reflected light off of circumstellar dust grains. This project will construct an astronomical spectropolarimeter and examine the results and limitations on a small aperture (235mm) telescope. This project demonstrates a design on a limited budget using (as much as possible) off the shelf parts. This spectropolarimeter follows an uncollimated beam, rotating compensator design and a transmission diffraction grating as a dispersive element. Due to the nature of the weak signal from astronomical sources, the exposure time necessary to achieve appropriate signal to noise prohibits a continuously rotating compensator. Therefore a sampling of compensator azimuth angles must be used with compensator azimuth angle held fixed during exposure, rotating the compensator to a new azimuth between exposures. The coordination between exposure and azimuth angle is best facilitated by motorized computer control. For this project a Raspberry Pi controls the motor that rotates the compensator using a PID control structure and also coordinates camera exposure times.

519. **A Hybrid Thermochemical and PSA Process of Air Separation**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
David Fitzpatrick, Undergraduate

Faculty Mentor:
Justin Lapp

Abstract:
The centralized distribution system of oxygen generation has allowed suppliers of industrial gas to create a duopoly thereby allowing them to maintain operating profits margins that are twice as large as the S&P 500 Materials sector. This exorbitant cost disproportionately falls onto the smallest consumers who are often healthcare facilities such as Maine hospitals. If it were economically feasible to produce high purity oxygen using a Pressure Swing Adsorption system, this type of system would make distributed generation feasible for individual hospitals. My project is to develop a model of a combined Pressure Swing Adsorption and Thermochemical process and compare its efficiency to the industrial standard, a cryogenic distillation system. I have been building a PSA model in MATLAB based on the model used by Shokroo et al. and plan to test the efficiency of this model under different conditions which can be used to determine the optimal crossover point when coupling to a thermochemical system. Determined by varying outlet purity of oxygen, flow rate and pressure. I will present these performance curves and discuss the impact on a combined PSA-thermochemical process.

Shokroo, E. J., Farsani, D. J., Meymandi, H. K., & Yadollahi, N. (2016). Comparative study of zeolite 5A and zeolite 13X in air separation by pressure swing adsorption. Korean Journal of Chemical Engineering, 33(4), 1391–1401.

520. **Increasing Access to Graphical Information for Blind and Visually Impaired People: Evaluating the usability of two haptic feedback methods using a touchscreen-based system**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jessica A. Holz, Undergraduate
Kaitlyn N. Haase
Nicholas A. Giudice

Faculty Mentor:
Nicholas Giudice

Abstract:
As an increasing amount of essential everyday information is presented through graphical means, information access becomes exceedingly challenging for blind and visually impaired (BVI) individuals. This limits their independence, social engagement, occupational and educational opportunities, and overall quality of life. The current research addresses the information access challenge for BVI people by evaluating the best haptic feedback method for providing real-time

access to combined textual and graphical information using a new touchscreen-based prototype system. This work describes a usability study comparing audio-vibratory and motor-vibratory feedback methods with the system to determine which is most effective and preferred by BVI users. A within-subjects study with six BVI participants was run, where participants were asked to learn several digital documents containing text and graphics (e.g., bar graphs) via three feedback conditions: an audio-vibratory, a motor-vibratory, and a traditional embossed-paper (control) condition. Three dependent measures were used to evaluate the usability and efficacy of each feedback method: a set of comprehension questions, a graph recreation task, and self-reported opinions. Results revealed no statistically significant differences across conditions in efficiency or effectiveness of the feedback methods, indicating that the prototype system is as feasible as traditional embossed, hard-copy methods for accessing and learning bar graphs, while providing the additional benefits of being multimodal and dynamic. Notably, 67% of participants preferred audio-vibratory feedback to motor-vibration and embossed-paper. This work supports efforts towards enabling BVI individuals better real-time access to graphical information; future work will further refine the best interfaces and modalities supporting this goal.

521. **Medical Software Interface for Detecting Early Neuropathy**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Andrew Piccirillo, Undergraduate
Noah Howard
Connor Langlois
Durgin Sweet
Henrikus Freeman

Faculty Mentor:
Terry Yoo

Abstract:
Neuropathy is a neurological condition that causes damage to the nerves outside of the brain or nervous system, resulting in weakness, numbness, or pain. To help clinicians diagnose and treat neuropathy, Neuright Inc. has developed the Detecting Early Neuropathy (DEN) device. We are currently partnering with Neuright Inc. to develop a medical software interface FOX-DEN (Fidelity Operation X-fer for Detecting Early Neuropathy) to interact with Neuright's DEN device. To implement such software, the system will be designed from the top-down with two software architectural patterns: MVC (model-view-controller) and client-server. In the MVC

approach, the system will consist of three separate divisions: the UI (user interface), the server, and the user. In the client-server approach, similar to MVC, the frontend will act as the client while the server acts as the backend, constantly in communication as needed to transfer data. Both the server and client will be designed in object-oriented fashions with a modular class structure (e.g. user, data, visualizations, analyses) for easier maintainability and extension.

522. **Integration of Electronics in Compliant Mechanisms**

Submission Type: Poster
Submission Category: Engineering

Author(s):
Li Mackenzie Ladd, Undergraduate

Faculty Mentor:
Brett Ellis

Abstract:
Filament Deposition Modeling (FDM) is a widespread and useful additive manufacturing process to manufacture inexpensive prototypes and small quantities of geometrically-complex parts. Until recently, FDM materials were limited to electrically-insulated thermoplastics, thus preventing FDM-manufactured integrated electro-mechanical devices. This research seeks to explore the ability of FDM-manufactured integrated electro-mechanical devices capable with the recent introduction of electrically-conductive FDM filaments. To accomplish this task, a custom FDM printer was built and modified to accommodate dual extruders and a custom heated bed such that electrically-conductive thermoplastics could be printed within the same layer as insulating thermoplastics utilized for mechanical structures. Next, 100 mm by 80 mm bistable switch, developed by Brigham Young University's advanced materials group, was modified with inlaid electrical components and manufactured and tested to determine the electro-mechanical properties. A bistable switch is the ideal device due to its simple nature, and is an excellent way to visualize what a compliant mechanism consists of, as well as providing a good structure to inlay the electronics. Results include characterization of mechanical wear due to thermal cycles, and conductivity and durability as a function of number of operating cycles. Mechanical wear will be characterized by an observation of the structure's geometry and observing failure points. This work is significant in that integrated electronics within 3D-printed structures could dramatically reduce the time to develop new integrated circuit devices while dramatically increasing their simplicity and reliability.

523. **Imaging Zebrafish with Duchenne Muscular Dystrophy using Second-Harmonic Generation to Evaluate Myosin Structure**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jordan Miner, Undergraduate

Faculty Mentor:
Karissa Tilbury

Abstract:
Duchenne muscular dystrophy (DMD), an incurable disease that causes weakness and loss of muscle mass, is caused by a mutation in the protein dystrophin. Sarcomeres, the foundational units of muscle contraction, are composed of thick myosin filaments. Myosin is a key protein required for proper muscle contraction and is impacted by DMD. An individual diagnosed with DMD is believed to experience hypercontraction of sarcomeres. By evaluating sarcomere length and myosin arrangement, we seek to understand the structural impacts of four different exercise regiments: endurance, hypertrophy, strength, and power on the myosin in wild-type and DMD zebrafish. Currently, confocal microscopy is used to study the two muscle fiber types: slow- and fast-twitch. However, confocal microscopy uses dyes, whereas second harmonic generation (SHG) imaging is label-free and will not distort the myosin structure. SHG microscopy is used in this study to explore spatial relationship of myosin in individual muscle fibers. Preliminary results show sarcomere length (Z-line to Z-line) of normal, wild-type zebrafish muscle fibers to be 1.83±0.08 μm. Endurance DMD sarcomere length was determined to be 1.72±0.14 μm and unexercised DMD was 1.61±0.15 μm. By comparing the wild-type sarcomere length to the sarcomere length in zebrafish with DMD, an understanding of the effect DMD has on myosin can be determined. Overall, this study will effectively combine SHG imaging with the use of zebrafish to properly evaluate myosin structure in muscle fibers, furthering our knowledge of DMD. Ultimately, this work aims to facilitate development of scientifically driven exercise routines for DMD patients.

524. **Quantifying the Mice Behaviors Using Markov Chain Analysis**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Ahmed Almaghasilah, Graduate
Michael Saul

Faculty Mentor:
Clarissa Henry

Abstract:
The diversity outbred mice behavior was observed in a hole-board assay and quantified through Mackov Chain analysis (MC). The typical mice behavior includes hiding in corners and gradually walking the perimeter of the arena. Once they find the environment is not life-threatening, they expose themselves and explore the middle of the arena. The hole-board arena is designed to hold an experiment that runs approximately 20 minutes per mouse, where the mouse is placed in the center of the arena facing the rear. The hole-board is a squared shape, clear polycarbonate arena with a dimension of 44.5cm in length and width. The floor of the arena consists of 16 infrared photobeam sensors arranged in a 4 by 4 configuration. These sensors are in the holes and record the time stamp when the mouse pokes a hole.
The MC revealed they actually favor transitioning back to the middle holes more than any holes in the arena including the corners. The MC highlights abnormal activities of a mouse thus enabling us to map the phenotypes responsible for particular behaviors to a set of genes. The consecutive, repetitive and pattern “pokings” frequently infer to these abnormal activities.

525. **Growth of Perkinsus Marinus by Bioreactor Fermentation**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Caitlin Murphy, Graduate

Faculty Mentor:
G. Peter Van Walsum

Abstract:
Perkinsus marinus is a protozoan responsible for “Dermo” disease in the eastern oyster species, Crassostrea virginica. In laboratory studies, parasites need to be grown in vivo, which complicates the study of the organism. However, In vitro cell culture for P. marinus at a small scale of was established in 1995(1). P. marinus is notable among easily cultured microbes in its ability to produce, fold and excrete large, complex proteins.

In 2014, mice with humanized T-cells were fed P. marinus; it was determined that they did not cause any noticeable pathology, but induced systemic immunity(2). This finding has led to the possibility of genetically modifying P. marinus for the production of an oral vaccine. Target diseases for vaccines include: malaria, Toxoplasma gondii, Cryptosporidium, and Ebola.
In order to be useful as an organism to produce therapeutic vaccines, we need to learn how to grow the organism at larger scale. Transitioning the growth procedures from culture vials to tenfold larger bioreactors will enable this scale up. Growing P. marinus in a bioreactor introduces new production variables such as: aeration, pH control, temperature control, and media cost. In this study we are developing methods to grow P. marinus in bioreactors and are seeking to lower the cost of the growth medium. Higher order cell culture comes with expensive media components, most notably fetal bovine serum, which provides essential growth factors and cytokines for growing cells. Finding a suitable replacement that is cost effective and provides the necessary nutrients will be key to successful scale up.

1Gauthier, J. D., & Vasta, G. R. (1995). In Vitro Culture of the Eastern Oyster Parasite Perkinsus marinus: Optimization of the Methodology. Journal of Invertebrate Pathology, 66(2), 156–168. https://doi.org/10.1006/jipa.1995.1079
2Wijayalath, W., Majji, S., Kleschenko, Y., Pow-Sang, L., Brumeanu, T. D., Villasante, E. F., … Casares, S. (2014). Humanized HLA-DR4 mice fed with the protozoan pathogen of oysters Perkinsus marinus (Dermo) do not develop noticeable pathology but elicit systemic immunity. PLoS ONE, 9(1), 1–10. https://doi.org/10.1371/journal.pone.0087435

526. **Simulation and Automated Design of Small Lighter-than-Air Unmanned Aerial Vehicles**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Brennan Barrington, Graduate

Faculty Mentor:
Wilhelm Friess

Abstract:
In the last two decades, the use of Unmanned Aerial Vehicles (UAV) for scientific and commercial survey and data collection has become widespread, including agriculture, forestry, meteorology, volcanology, and glaciology. This is due to the miniaturization of modern multispectral cameras, LIDAR, and other remote sensing equipment. Small Lighter-than-air

(LTA) UAVs (less than 10 meters long, or with less than 3 kilograms of payload) may be useful for this due to their high endurance, hover capabilities, and low power use. To improve the design of such aircraft and evaluate new approaches to them, a simulation is needed to model their behavior and automate the design process. For example, hybrid lift LTA aircraft use wing-shaped envelopes to obtain dynamic lift in addition to the usual static lift; a rigorous approach to simulating this is needed. By integrating the numerical modeling of both buoyant and dynamic lift, thrust, weight, power requirements, static stability, and structural integrity, all relevant parameters of the design can be considered. This project is developing algorithms to automate the design of such UAVs for specific applications by iterating over submodules that simulate the above aspects. Going forward, the model will be refined to produce more comprehensive and precise results, considering laminar flow, envelope superheating, wind gust response, and so forth. The finished software will be used to evaluate the potential of new small LTA UAV approaches and applications.

527. **Reaction kinetics analysis of ethanol conversion over MgO-SiO2**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Hussein T. Abdulrazzaq, Graduate
Amir Rahmani Chokanlu
Brian G. Frederick
Thomas J. Schwartz

Faculty Mentor:
Thomas J. Schwartz

Abstract:
The research area in the past years has emphasized on the investigation of new routes for producing higher fuels and valuable bulk chemicals. Butadiene is a common application of higher value chemicals that can be obtained via catalytic conversion of biomass derived ethanol molecule. These upgrading movements are one of the most impact trends which have been taken recently, but these network reactions are still subjected for debate with many inconsistent mechanisms. In this study, we propose tentative mechanisms describing the first steps in the ethanol catalytic conversion involving dehydrogenation and dehydration reactions over Mg-Si oxides catalyst, and provide a well understanding to the reactions that occurring on the surface of the catalyst. A 0.08wt % MgO/SBA-15 was chosen to be used as a well-defined model catalyst to test the first steps of ethanol conversion involving dehydrogenation and dehydration reactions.

This catalyst was prepared by incipient wetness impregnation method. We have probed the catalyst activity for the catalytic conversion of ethanol to ethylene and acetaldehyde at different temperatures. We have also inspected the site activity involving the site requirements of dehydration and dehydrogenation reactions and specified the nature and density of the active sites on the surface of the catalyst. Additionally, we have illustrated the influences of the intermediate steps on the formation mechanisms of ethylene and acetaldehyde respectively, and we have also signified the abundant surface intermediates. The acetaldehyde and ethylene formation rates were collected in packed bed continuous flow reactor at ethanol conversion <10%. The catalyst was found to be governed by two parallel deactivation processes. The acetaldehyde and ethylene synthesis rates were demonstrated to be in fractional order at 723 K, decreasing to nearly zero-order at 648 K. However, we have proposed mechanisms describing the elementary steps of dehydrogenation and dehydration reactions of ethanol conversion over magnesia silica oxides catalyst. These mechanisms hypothesis were supported by kinetic isotope effects observations and active sites titration experiments that consistent with the assumptions that proposed. Finally, these mechanisms hypothesis were also consistent with experimental measured reaction kinetics data that collected wherein the C-H bond cleavage is assumed to be the rate controlling step for acetaldehyde formation. While for ethylene production, we postulate that the simultaneous scission of the C-H and C-O bonds is the rate-controlling step.

528. **Surface Acoustic Waves for Cancer Biomarker Detection in Liquid Biopsies**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Joel Tewksbury, Graduate
Caitlin Howell
Mauricio Periera da Cunha

Faculty Mentor:
Caitlin Howell

Abstract:
Pancreatic cancer has a survival rate of less than 5% five years after diagnosis. This low survival rate is due to the lack of symptoms until to cancer reaches its late stages. Developing cheap, effective screening tools is a critical step in the fight against this disease. One promising method of screening is separating and identifying biomarkers in blood that are indicative of pancreatic cancer. The purpose of this project is to develop a system using surface acoustic waves (SAW) and microfluidics to separate pancreatic cancer cell components in blood. Surface acoustic waves

are a relatively simple, effective, and compact method of manipulating particles in liquid. For this application, the biomarkers of specific interest are exosomes that have been released from the tumor cells. The planned setup involves pushing a blood sample through a microfluidic channel on top of a SAW device. The SAWs are generated by using an array of interdigital transducers (IDTs) that convert the electrical energy into acoustic waves on a piezoelectric crystal. These devices can be used for a variety of functions including separation, concentration, particle patterning, and particle or droplet manipulation. The SAW propagates through the material and into the fluid, exerting a force on exosomes in solution and the fluid itself. Once separated and manipulated via SAW, an attempt will be made, in collaboration with researchers at Dartmouth Medical School, to combine this process with immunomagnetic techniques to capture the exosomes, enhance the signal, and pattern them into an array for easier diagnostic testing.

529. **Finite Element Analysis of Glucose Diffusivity in Peripheral Nerve Conduits**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Nicklaus Carter, Graduate
Julia Towne

Faculty Mentor:
David Neivandt

Abstract:
Peripheral neuropathy is estimated to afflict 20 million people in the United States. Most cases of neuropathy result from physical injuries and trauma arising from automobile accidents and war. Peripheral nerves have the intrinsic ability to regenerate over time, bridging the injury gap resulting from trauma. Current methods utilized to assist in the regeneration of peripheral nerves include nerve grafts and neural conduits. Nerve autografts are regarded as the most effective method but require a second surgical site to access a donor nerve or a nerve donation from another individual. Current available conduits have equal or lower success rates relative to nerve grafts with specific issues including immune response and stability insufficiencies. It has been proposed that a biocompatible material such as cellulose nanofiber may serve as a viable alternative conduit material. Preliminary studies have shown that cellulose nanofiber conduits are successful in aiding neural regeneration and further, that conduit length has an impact on efficacy in murine models; it is hypothesized that the length dependence may be related to modified diffusion distances of key cellular nutrients and waste metabolites. The present work

investigates the concentration profile of a key nutrient, glucose, within the conduit. A finite element analysis of the conduit system has been established using COMSOL Multiphysics. Variations in the physical dimensions of the conduit were investigated to determine the impact on glucose concentration profiles. The resultant information is being used to aid in the development of improved conduit designs to optimize functional recovery of peripheral nerve injuries.

530. **Wireless Dynamic Strain Sensor for Harsh Environments**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
David Leff, Graduate
Anin Maskay
Mauricio Pereira da Cunha

Faculty Mentor:
Mauricio Pereira da Cunha

Abstract:
Dynamic strain sensing is required in industrial applications regarding parts design, condition based maintenance of equipment and structures, and manufacturing. For harsh-environment applications, including aerospace, oil wells, and power plants, these sensors are needed in high-temperature, hard-to-reach locations to monitor strain and ensure the structural health of equipment, increase process efficiency, reduce maintenance cost, and increase safety. Strain sensing in such environments comes with challenges including sensor stability, mounting procedure, and data acquisition capabilities. Surface acoustic wave (SAW) sensors have been shown thorough previous work at UMaine to operate above 1000°C and to be sensitive to temperature, in addition to being compact, not requiring a battery, thus making them a potential solution for harsh environment dynamic strain sensing. Static and dynamic strain SAW sensor tests have been previously performed at UMaine, limited to 400°C and wired connections. Wireless interrogation of SAW strain sensors is desirable over wired sensing because it eliminates high temperature cables directly attached to the device, which require fragile bonds to the sensor, and allows for simpler packaging techniques that protect the SAW from being compromised by particles in the environment. In this work, SAW dynamic strain sensors targeting wireless operation have been designed, fabricated, and tested between 20°C and 400°C. The SAW was mounted on a constant stress beam and calibrated with a high temperature wired commercial strain gauge. Inductive coupling technique was used to wirelessly interrogate a SAW

sensor around 300MHz. Due to the lack of wires connecting the sensor to cables, it is expected that these wireless capable sensors will have improved performance (stability and isolation from erosive/corrosive environment) and facilitate the insertion of this technology in harsh-environment applications.

531. **Using liquid infusion to create anti-infection catheters**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Junie Fong, Graduate
Caitlin Howell

Faculty Mentor:
Caitlin Howell

Abstract:
Although catheterization is a very common procedure, the presence of catheter increases the risk of having urinary tract infection up to 80-100%, which causes complications such as the colonization of variety of pathogens. Current approach of treating catheter-associated urinary tract infection involves the usage of antibiotics- this is not fully effective due to the presence of biofilms that form on the surface of catheters, which would protect the pathogens from the antibiotics and the patient's immune system. To address this problem, we have created and characterized liquid-infused silicone catheters and catheter analogs for in vivo studies of catheter-associated urinary tract infections. To standardize the infusion process, the masses of silicone tubes and mouse catheters were measured over time during silicone oil infusion. Results showed that it takes 5-6 days for human catheter-sized silicone tube to reach complete infusion, while it takes 15-20 minutes for mouse catheters. After infusion, length, outer diameter and inner diameter of both type of tubes increased, but to a different extent. In addition, infused silicone tubes showed a lower-adhesion surface to which less protein could attach. Crystal violet dye droplets were able to slide down an infused tube within 2.7s at 15°, while the droplets remained stationary on non-infused tubes held at the same tilting angle. Crystal violet dye also stained non-infused silicone tubes more than infused silicone tubes after incubation in whey protein solutions or milk, showcasing the anti-fouling properties of infused tubes. These results aid the standardization of the infusion of catheters and they are currently undergoing in vivo testing, which could contribute to the next generation of catheters that resist infection.

532. **Learning to Trust Autonomous Vehicles**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Paul D. S. Fink, Graduate

Faculty Mentor:
Nicholas Giudice

Abstract:
Fully Autonomous Vehicles (FAVs) represent a massive innovation to how people will interact with and navigate the world. The problem remains, however, that people simply do not trust self-driving cars, despite the improvements to safety and efficiency they represent. Although the human trust problem, as it is often referred, introduces significant barriers to consumer acceptance of FAVs, the vast majority of autonomous research has patently ignored this important human factor. To address this gap, this research facilitates trust between humans and the vehicles of the future by leveraging, and ultimately extending, a well-established strategy employed by other emerging AI technologies: human-like virtual personas. Much like Apple's Siri and Amazon's Alexa, which helped overcome user reluctance to AI integrated phones, homes, and workplaces, this research investigates the efficacy of using anthropomorphized AIs to overcome the human trust problem currently limiting AI integrated vehicles. This research will utilize a virtual learning platform in which users and AI personas engage in a bidirectional process of information-access for enabling human-in-the-loop collaboration. Data collection focuses on increasing trust, as measured by normalized FAV trust surveys and human biometric responses. Ultimately, results from this initial learning process will enable the study of human-AI interactions over specific spatio-temporal driving events. Outcomes of this work are predicted to provide transportation stakeholders and designers with guidelines for increasing user trust through AI personas at the wheel of FAVs, thereby paving the way for meeting human needs and saving lives through widespread user acceptance.
Supported by NSF-grant CHS-1910603

533. **Simulation of Energy Requirements for Drying Kelp in Maine**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Tuqa Al-Asadi, Graduate
G.Peter van Walsum

Faculty Mentor:
G.Peter van Walsum

Abstract:
Seaweed (macroalgae) is a marine resource that has a high economic value. One of the popular seaweeds is Sugar kelp (Saccharina latissima), which is a rich source of fibers, minerals, and antioxidants. Maine state coastline is rich in sugar kelp. This seaweed has high moisture content and will spoil quickly if not preserved, therefore it has been preserved as dry product to prolong storage life and to minimize the cost for transportation. Understanding its properties as it dries is important for retaining product quality and improving shelf life through optimized post-harvest processing. A drying method using warm air will decrease moisture content and prevent high drying temperature which degrades the food quality. A first of a kind drying system with controlled temperature, air flow and exit humidity has been developed and assembled in the advanced manufacturing center (AMC) within the University of Maine. The focus of this study is examining the drying time, temperature and humidity within the drying process, the rate of drying, and energy efficiency of the process. Several approaches have been developed to model the drying dynamics of the kelp. ASPEN Plus, a chemical process simulation software, was used to model the energy costs and capacity of the drying process. The model determined the amount of seaweed throughput that could be sustained at different ambient air conditions and the energy costs of the fan and heater systems. A parallel modeling effort is using COMSOL Multiphysics computational fluid dynamics software to predict the pressure drop through the dryer.

534. **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, Graduate

Faculty Mentor:
Mauricio Pereira da Cunha

Abstract:
A Normal Mode Helical Antenna (NMHA) is a combination of short electric dipole and short magnetic dipole. Hence, it can achieve a self-resonance but has very low radiation resistance since size of antenna is very small compared to conventional antennas used around 300MHz frequency range. One of the advantages of this model is that it can be used in complex environments and near metals. It can also have increased gain in close proximity to a metal reflecting surface. This type of antennas has been applied in tire pressure measuring system, car remote smart key and RFID tags.
In this work a NMHA is designed to operate with SAW device. The system consists of a SAW resonator operating as a sensor (temperature, strain, gas, etc.) integrated with the sensor antenna. The system is meant to operate at temperatures in the 500-900°C range. In such harsh environments, the usage of dielectrics is limited and the temperature dependence of these materials often significantly impact the antenna response, such as their frequency response. Regarding size, the SAW device operating around 300MHz is of the order of a few mm2 and thus a small antenna is desired. Close proximity to metals surfaces, a boundary condition usually encountered in harsh environment applications, poses another challenge to most antennas, and is also under investigation for the NMHA. Considering all these factors, a compact NMHA antenna has been designed, fabricated, and tested and is currently under adaptation for integration with the SAW sensor.

535. **Multiplexed SERS Imaging in Biological Systems using Biocompatible Raman Active Nanostars**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Jeremy Grant, Graduate

Faculty Mentor:
Michael Mason

Abstract:
The objective of this study is to design a nanoparticle labeling system suited for enhanced Raman micro-spectroscopic imaging to directly probe the concentration, chemical dynamics, and spatial distribution of individual Raman active nanoprobes at nanometer length scales in biological systems. Surface-enhanced Raman spectroscopy (SERS), using specifically engineered spherical metallic nanoprobes for chemical sensing, has received considerable

attention recently. It is considered a powerful alternative to fluorescence labeling, offering several advantages over traditional methods, including increased photostability, narrower emission peaks, allowing for simultaneous observation of a larger number of “channels”, and ease of bioconjugation. Unfortunately, most existing nanoparticle geometries require mean diameters on the order of 50-80 nm to provide single particle signals comparable to those observed via competitive fluorescence methods. We propose to investigate a new nanoparticle geometry based on a star-shaped architecture which shows further enhancement over spherical particles. We further propose to create 10 spectrally distinct Raman active nanostars, overcoming the channel limitations encountered using standard fluorescence labeling methods. We will also develop the enhanced software required to obtain and analyze the Raman signal data by improving the computational efficiency of our current scanning software while adding spectral multiplexing algorithms.

536. **Extending Apache Spark for Spatio-Temporal Point Clouds**

Submission Type: Poster
Submission Category: Engineering and Information Sciences

Author(s):
Iranga Subasinghe, Graduate

Faculty Mentor:
Silvia Nittel

Abstract:
Increasingly large numbers of sensors are deployed in physical space, live-streaming observations. Sensor data streams, where sensors can be devices or humans, are a fundamentally novel mechanism to continuously deliver real-time observations to geographic information systems. To understand the raw data, streams need to be correlated with each other over time and space, and integrated with other, more traditional, stored data sets. Additionally, with a large geosensor network, the onslaught of constantly arriving data can be tremendous. Particularly, higher throughput of data may increase the processing time of the data. Data stream engines (DSEs) make it feasible to monitor and analyze phenomena that are continuous in space and time while delivering real-time answers to queries. The focus of the current work is extending the support for processing spatio-temporal (ST) data streams in real time using an open-source DSE, Apache Spark to deliver continuously updated representations in real time.

However, Spark only has primitive support for ST data streams, especially for the point data type. The proposed design provides a generic extension approach for Spark to process ST point

cloud data and provides an interface for processing ST queries over streams that deliver results in real time. Our approach is to extend the Spark's core resilient distributed dataset (RDD) data structure and introduce a novel data structure called ST-RDD to support ST data streams with ST operators.

537. **Automated Detection of Health Hazards in Autonomous Vehicles**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
Mitchell Harling, Undergraduate
Hannah Varney
Nicole Bailey
Dr. Robert Bowie, M.D.

Faculty Mentor:
Robert Bowie

Abstract:
As the transportation industry shifts towards the use of shared autonomous vehicles (SAV), the absence of a driver, and therefore a lack of passenger accountability, may result in unsanitary conditions within vehicles. This shift affords individuals with disabilities, e.g., limited vision, increased opportunity for mobility; the cleanliness of SAVs is imperative to ensuring this benefit. Cleanliness detection systems have been designed, but lack interaction with the user. Here a novel system that determines the level of cleanliness within a ride-sharing vehicle and relays the information to the passenger and ride-sharing company is presented. Health hazard detection is completed by identifying physical changes in the car via subtraction of images taken when illuminated with alternating white and black light. Furthermore, a temperature sensor will detect passenger presence, and a sound detector will identify coughing and sneezing which is indicative of potential contagions. To assess the efficacy of the camera, temperature sensor, and sound detector, three experiments were conducted: the ability of the camera to identify the presence of a majority of objects, regardless of color and shade; the ability of the temperature sensor to be effective in passenger identification by recognizing a temperature drop in the interior as the passenger exits the vehicle; and the ability of the sound detector to distinguish coughs and sneezes from normal conversation. This system, which is able to accurately detect potentially dangerous changes to the interior of the car and duly notify consumers and ride-sharing companies, would accelerate the acceptance of SAVs.

538. **Development of a Point-of-Care Veterinary Device for Microfluidic Blood Separation**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
Erin Merchant, Undergraduate
Oisin Biswas
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Lauren Ryan
Dr. Anne Lichtenwalner

Faculty Mentor:
Caitlin Howell

Abstract:
There is a shortage of large-animal veterinarians in the United States, especially in rural and remote areas. As a result, many farmers need to perform a variety of veterinary procedures including serological diagnostic tests on their own. However, some tests require separating blood samples using centrifugation, which requires the assistance of a veterinary professional. The purpose of this work is to develop a device that permits blood separation on-site by farmers without the need for expensive centrifugation equipment. To fill this gap in the veterinary field, we built a point-of-care device to separate blood components, consisting of two main elements: a handheld spinning device and a microfluidic channel system. The device function was validated through experiments related to 3D print and molding quality, rotational speed as a function of weight, and blood component separation time and quality. First, the microfluidic channels were compared to the expected dimensions from the Computer Aided Design (CAD) model to ensure adequate printing and casting resolution (+/- 0.01mm). Further tests were conducted to determine the effect of device mass on rotational speed to confirm that appropriate centrifugal force needed for blood separation is achieved. Another test measured functionality of the device by quantifying the required spinning time and as compared to centrifugation procedures. The preliminary tests of this device indicate that it could help farmers to perform more of their own diagnostic tests, reducing the pressure on large animal vets and increasing overall large-animal health.

539. **Autonomous, Modular, Indoor Growth Chamber for Produce**

Submission Type: Exhibit/Performance

Submission Category: Engineering and Information Sciences

Author(s):
Katherine Kirk, Undergraduate
Jordyn Long
Lindsey Durgin

Faculty Mentor:
Andre Khalil

Abstract:
A substantial portion of the world's population resides in urban areas, and this quantity will continue to grow as the population rises. Individuals in urban areas are faced with limited access to fresh produce due to spatial restrictions and the time-consuming nature of produce production. Current solutions include community gardens, rooftop agriculture, and indoor hydroponic systems, which are often noisy, prone to fouling, and do not optimize space or provide a sufficient level of autonomous monitoring. The purpose of this work is to address the location-prohibitive access and time-consuming work associated with growing fresh produce in urban areas. To do this, an autonomous, modular, indoor growth chamber called UPLANT (Urban, Produce, Long-Lasting, Autonomous, Nutrient-Dense, Technology), is being built to hydroponically grow nutrient-dense plants in a 2'x2'x2' cube. Its function will be validated by testing its key components: soil-alternative growth medium (expanded clay pellets), temperature sensor, conductivity sensor, linear actuators, and LED grow lights. Plant growth in the expanded clay pellets will be quantitatively compared to growth in traditional soil. The temperature and conductivity sensors as well as linear actuator accuracy will be quantified, and linear actuators and LEDs will also be tested for consistency. The theoretical load bearing capacity of the chamber will be evaluated numerically with a statics problem, to assess the stacking capabilities of the chambers. The results will act as a step towards addressing the location-prohibitive access and time-consuming work associated with growing fresh produce in urban areas through the use of UPLANT.

540. **Biohazardous Chemical Detector Suite for Firefighters**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
Mary Dube, Undergraduate
Kaitlin Stewart
Ines Khiyara

Betelhem Abay
David Neivandt

Faculty Mentor:
David Neivandt

Abstract:
Firefighters are facing increasing mortality and morbidity rates due to exposures to biohazardous chemicals in their line of duty. However, the affordable gas detectors currently employed only detect a single hazardous chemical, leaving firefighters potentially exposed to diverse unmonitored chemical threats. While multi-sensor gas detectors are available, they are too expensive for fire departments to provide one for every on-scene firefighter. Thus, there is a need for a multi gas-sensor which alerts firefighters of danger in real time and which is less expensive than existing devices. The purpose of the current capstone project is to address the mortality and morbidity rate of firefighters due to the exposure of biohazardous chemicals in a way that does no harm and creates no interference to the user. To meet the stated needs, a multi-gas detection device was designed and built to be worn on-scene by firefighters. Device function was validated in five quantitative ways: temperature resistance of the 3D printed casing, comparison of the device grip for comfort and effectiveness against existing devices, testing of the device's oxygen sensor, testing of the durability of the device's concussion boot, and testing of the device's vibrational strength and the alarm system volume. The multi-gas detection device is low in cost to build, which is a significant factor when considering the selling price for fire departments. These results demonstrate that the device, the Tunaep, is a step toward addressing the need for a safe and affordable multi-sensor gas detector.

Acknowledgements:
The authors thank Dr.Bowie our DEEMI Client for the use of pre-existing gas detectors and first responder knowledge.

541. **The Headset for Aviation and Life-Saving Operations (H.A.L.O.)**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
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Miranda Jacques
Ryan Fairchild
Chika Nduaguibe

Michael Mason
Faculty Mentor:
Michael Mason

Abstract:
In the event of an aircraft accident, an array of data pertaining to the mechanical and operational status of the aircraft is documented. However, the National Transportation Safety Bureau (NTSB) does not currently require that data about the health status of the pilot during flight be recorded. A lack of real-time monitoring can make it difficult to eliminate the possibility of an undetected medical issue leading to a crash. The purpose of the work described here is to create a device that is minimally intrusive and can be used to correlate pilot health status with aircraft events. To accomplish this, our team developed a Headset for Aviation and Life-saving Operations (H.A.L.O.) which is equipped with a suite of biometric sensors that can monitor heart rate, oxygen saturation, body temperature, rate of respiration, presence of perspiration, and head motion during flight. Each sensor was calibrated independently and compared to a medical standard to ensure accurate results. The H.A.L.O. was also designed to be a non-invasive monitoring system. To validate this concept, the flight preparation time with the H.A.L.O. was recorded to be within acceptable operational standards. Additionally, the mass of the overall sensor suite complies with the U.S. Forestry Department headgear constraints. Based on the results presented for the H.A.L.O. system, this device will address the lack of pilot health monitoring during flight by helping crewmembers recognize health conditions that could affect the pilot's ability to fly safely.

542. **THED: A Wrist-Worn Thermal Display for Spatial Thermal Interactions in Virtual Reality**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
Nicholas Soucy, Undergraduate
Meetha James

Faculty Mentor:
Nimesha Ranasinghe

Abstract:
THED is a wearable thermal display designed to allow users to perceive spatial thermal sensations within a virtual reality (VR) environment. THED consists of a wrist-worn thermal

stimulation module and a control module utilizing Bluetooth communication to connect with the VR environment. To demonstrate THED, we have developed a VR environment showing a virtual campfire in a snowy climate where participants were able to experience the virtual campfire in different predetermined distances. We have conducted a user experiment to 1) determine the distance-based perception of spatial thermal sensations in a VR setting, 2) determine the differences of thermal stimuli on participants' wrists, and 3) evaluate the effects of combined thermal stimuli towards their expected spatial thermal stimuli. Our primary aim of this study is to learn how humans spatially perceive thermal sensations on their hands (utilizing only one hand vs. both hands) when given a wrist-worn thermal source coupled with a virtual reality scenario. Our findings show that different thermal stimuli utilized by THED were able to provide thermal sensations in virtual reality that closely mirrored participants' expected thermal sensations in respective VR conditions.

543. **Defense Mechanism**

Submission Type: Exhibit/Performance
Submission Category: Engineering and Information Sciences

Author(s):
Stephanie Poirier, Undergraduate
Helen Rose

Faculty Mentor:
Vincent Weaver

Abstract:
The Defense Mechanism is an exhibit that embodies technology and art. It is an embedded system that is enclosed in a sculpture. The system uses an ultrasonic sensor to detect the proximity of viewers and when something is too close, the sculpture closes. The sculpture is an octagonal box with an 8 petal lid. When an object or viewer is within 2cm to 122cm away, the sensor will communicate with a Raspberry Pi and the Pi will communicate to a DC motor to rotate. The rotation will close the lid so the viewer can not see into the sculpture. When there is nothing within range of the ultrasonic sensor, the Pi will communicate to a DC motor to rotate the opposite direction to open the box and turn on an LED string.

544. **InfinityVR**

Submission Type: Exhibit/Performance

Submission Category: Engineering and Information Sciences

Author(s):
Jack Lampinen, Undergraduate

Faculty Mentor:
Joline Blais

Abstract:
Virtual Reality (VR) is the future. As it develops over time, more senses will be simulated, physical sensations will be implemented, and eventually, believable submersion into a virtual reality will be possible. While VR has been around for a few decades, it is still a long distance away from being completely immersive. Instead people have been trying to simulate digital versions of the real world. I believe there is far more potential for this technology. Simulating non-euclidean geometry would allow for physics that are impossible in our reality to takeover the laws that we are accustomed to, making it possible to convince users that space can be warped, as it is in spherical or elliptical geometries. This creates a space in which movement is seemingly unrestrained and thus produces an environment
that is non-intuitive, yet convincing. The goal of this project is to illuminate the potential of combining this technology and these mathematical concepts so that attention is brought to the unusual spaces and benefits that non-Euclidean VR might offer. By the end, I will have developed a series of demonstrations of these concepts in VR that people will be able to experience which will do so.

545. **Simulating Varying Hydrogen Flow Patterns in Solar Powered Lunar Oxygen Production**

Submission Type: Oral Presentation
Submission Category: Engineering and Information Sciences

Author(s):
Christopher DeMarchi, Undergraduate

Faculty Mentor:
Justin Lapp

Abstract:
The project studies the different flow profiles of hydrogen gas for use in lunar oxygen production. Oxygen is a vital resource for the future colonization of the moon, due to the dual use in refueling rockets and habitation. Oxygen can be extracted from the lunar soil, by a process

where high temperature soil reacts with hydrogen gas flowing over the heated soil, which produces steam. The steam is later processed in a different part of the device via electrolysis to separate the hydrogen and oxygen. It is important to look at different hydrogen flows for the reaction to find the most efficient design in order to maximize the amount of oxygen extracted. Simulating different hydrogen flows in the reactor is achieved with ANSYS FLUENT. To gather the necessary information for the simulation, analysis was done to find mass flow rate and the temperature of the chamber during reaction. The cases looked at are in 2D, and will include heat transfer and turbulent flow. The velocity, pressure, and temperature contour graphs generated allow us to analyze the effects of the different nozzle locations, and better understand how the hydrogen interacts with the reaction chamber. Looking at how the varying pressures, orientation and position of the inlet gas, hydrogen, used for the reaction will allow us to implement them. This research allows for designing a reactor with better understanding and confidence. An increase in efficiency will allow refueling times to decrease, leading to more missions, and increased reliability of oxygen production.

546. **Dermal ISF Collection Using a Silicon Microneedle Array**

Submission Type: Oral Presentation
Submission Category: Engineering and Information Sciences

Author(s):
Caleb Berry, Graduate
Zachary Smith

Faculty Mentor:
Rosemary Smith

Abstract:
Interstitial fluid (ISF) is a cell-free, living tissue medium that is known to contain many of the same, clinical biomarkers of general health, stress response and immune status as in blood. But, a major hurdle to the adoption of ISF as a diagnostic matrix is the lack of a rapid, minimally invasive method of access and collection for analysis. Microfabricated arrays of microneedles that can rapidly and painlessly access and collect dermal ISF for bioassay, in lieu of venous blood, could greatly facilitate point-of-care diagnosis and health monitoring, especially in austere environments.
We have developed hollow, silicon microneedle arrays that rapidly (10-15 min) collect approximately 1 µL of ISF from 1 cm2 of human skin. ISF collection was only achieved with needles of a specific geometric shape. To inform microneedle mask design and fabrication process, a 3D silicon etch simulation program was developed to predict microneedle shape

evolution. The 3D etch simulation results and two methods of wafer-scale microfabrication are presented with which microneedles of the requisite size and shape have been realized. An example of in vivo application and ISF collection are shown.

547. **Optimizing Liquid-Gated Membranes for Bioaerosol Capture and Release**

Submission Type: Oral Presentation
Submission Category: Engineering and Information Sciences

Author(s):
Daniel P. Regan, Graduate
Caitlin Howell

Faculty Mentor:
Caitlin Howell

Abstract:
Opportunistic pathogens that take form as bioaerosols present unique challenges for disease surveillance and treatment. Traditional mitigation strategies against bioaerosols are centered around high-efficiency particulate air (HEPA) filters. While HEPA filters excel at trapping airborne particles within the filter, they do not enable transfer of entrapped pathogens for pathogen detection. The aim of this work is the development of a catch-and-release filter that easily transfers the trapped bioaerosols to a platform for biological identification. To fabricate a catch-and-release filter, this work will optimize the working parameters of liquid-gated membranes. Parameters of infusing liquid viscosity, volume, and recovery time have been analyzed with aerosolized Escherichia coli. Preliminary results show that an optimized configuration exists for the novel use of liquid-gated membranes for bioaerosol capture and release. The next panel of testing will expand the bioaerosols species to include Pseudomonas aeruginosa and Staphylococcus aureus to represent traditional respiratory pathogens. The optimization of liquid-gated membranes for bioaerosol capture and release will bring about the next-generation of airborne pathogen surveillance and treatment.

548. **Characterization of Layered Media with Multispectral Spatial Frequency Domain Imaging**

Submission Type: Oral Presentation
Submission Category: Engineering and Information Sciences

Author(s):
Wyatt Austin, Graduate

Faculty Mentor:
Karissa Tilbury

Abstract:
An increasingly popular non-contact, model-based technique to extract tissue optical properties is Spatial Frequency Domain Imaging (SFDI), which utilizes spatially-structured illumination and a camera to sample wide-field tissue optical properties. Traditionally, calibrated images of diffuse reflectance are transformed to bulk absorption and scattering maps via a lookup table generated from a homogeneous tissue model. These optical properties can be used to estimate tissue composition and structure based on the absorption and scattering properties of molecules assumed to be present in tissue, such as oxy- and deoxyhemoglobin. One drawback of this technique is that it assumes tissue is a homogenous structure. This limits our ability to extract layer-dependent properties which may hold valuable clinical information. In this work, we propose a machine-learning-based algorithm to extract absorber and scatterer concentrations from a simple 2-layer model inspired by skin. A multi-spectral, multi-frequency SFD reflectance database was generated via a 2-layer GPU-accelerated Monte Carlo photon simulator where spectral properties of nigrosin (absorber) and titanium dioxide (scatterer) at various concentrations serve as the input. A series of neural networks (NNs) were then trained on the data set containing 100,000 input-output pairs which map 2-layer concentrations to SFD reflectance over 8 wavelengths [470 - 850]nm and 5 spatial frequencies [0 – 0.2]mm-1. The NNs were able to generalize the data set well with a mean squared error less than 7 *10-5 for each parameter. Two-layer nigrosin and TiO2 silicone phantoms were fabricated and imaged to validate the model. Our results show that we are able to separate the nigrosin concentrations from the 1mm top layer and the semi-infinite bottom layer with an error between 5% and 30%.

Arts

Projects 601 - 606

Arts

601. **Passamaquody-Maliseet Language Revitalization Through Song**

Submission Type: Poster
Submission Category: Arts

Author(s):
Sophia Crockett-Current, Undergraduate

Faculty Mentor:
Richard Corey

Abstract:
Passamaquoddy-Maliseet is an Algonquin dialect spoken in Maine and Canada. With an estimated 500 speakers, most of whom are over sixty, it is highly endangered. There have been attempts to preserve Passamaquoddy-Maliseet that focused on direct translation. However, this method is ineffective for revitalization: it produced no new speakers, and due to Passamaquoddy-Maliseet's more context-based nature, direct translation often destroys the original meaning. A group of Passamaquoddy women and our team explored the use of song as an engaging way to let new speakers familiarize themselves with the language. This method is based on the personal experience of the native speakers, preliminary user testing in the USM Passamaquoddy-Maliseet language courses, as well as other studies showing the efficacy of music as an instructional tool. We applied this method with an online platform featuring original Passamaquoddy-Maliseet songs recorded by the client group and an animation of one of the songs. It would have been optimal to remove any presence of English from the project, but as the animation team only speaks English, a translation was required to be able to properly storyboard the animation. Language barriers between the animation team and native speakers added more development time to the project than originally anticipated. This work has focused more on collaborative efforts between the clients and animation team.Through iterative design, the goal is to create a complete song and animation as part of an effective online resource for new Passamaquoddy-Maliseet speakers.

602. **Paper, Pulp, and Practice: Investigating Connections Through Process Art**

Submission Type: Exhibit/Presentation
Submission Category: Arts

Author(s):
Olivia Bradstreet, Undergraduate

Faculty Mentor:
Ronald Nadeau

Abstract:
A small papermaking studio was assembled for making archival quality handmade papers and pulps appropriate for printmaking, book arts, and paper cast to demonstrate the connections between artist practice, materials, and medium through process art. In the home studio a variety of machine made cotton and abaca linters from an artist supplier were torn by hand and beaten by individual fiber types with a standard kitchen blender. Pulp batches were pH tested throughout and common papermaking additives were mixed into the pulp in controlled measurements to decrease acidity, decrease bleeding from later application of paint or ink, and bond added pigments to the fibers. Sheets were pulled in batches from a vat using a board and deckle, pressed between boards, and then dried in a box dryer system. Sheet quality varied as the blender chops instead of traditionally beating fibers together, leading the pulp textures to be inconsistent between batches. Application of the wet sheets and pulps for paper cast demonstrated that the blender method for pulping is most effective when processing pulp for paper casting and heavy sheet forming. Further study and materials, such as a cement pulp mixer, are needed to test uniform sheet formation methods in the small studio. This study suggests that by working with an art substance through many steps of formation, an artist has more control and connection to the medium itself creating a deeper dialog between process art and material applications.

603. **When I Live at Home Again: Changing Domesticity**

Submission Type: Exhibit/Presentation
Submission Category: Arts

Author(s):
Rachel Church, Graduate

Faculty Mentor:
Susan Smith

Abstract:
Food is a vehicle to connect with one another. It can communicate who we are, where we come from, and what we value. As an artist I am using autoethnography, family history, and my

research in food and cookbooks, particularly manuscript cookbooks, to investigate the history and changes in domesticity, tradition, and female experience. Using a combination of performance, interactive installation, video, audio, and books arts, I invite the viewer to contemplate their own experiences with food, domesticity and the changing roles of women.
Acknowledgements
The video toaster oven piece which will be on view was funded by an Intermedia MFA Research Grant. All other costs were self-funded.

604. **NeurAuto, A Method of Self Understanding**

Submission Type: Exhibit/Presentation
Submission Category: Arts

Author(s):
Joshua Couturier, Graduate

Faculty Mentor:
Owen Smith

Abstract:
NeurAuto, is an Intermedia MFA grant funded application that allows individuals to become more self aware. When documenting daily experiences one can become more mindful of successful and unsuccessful experiences in life. The application digitizes a self based research method that Josh has used to maintain balance and achieve his goals. Thus he’s minimized his carbon footprint while growing his research practices, and community outreach.
He believes that the delivery of this tool and method into the masses will aid others in the same endeavor, reducing their carbon footprints, becoming more mindful of themselves, and reaching into untapped potential.
It's easy to blame climate change on big corporations and flawed legislation, but i believe in a more proactive approach. The power of change sits with each one of us, as does the challenge of becoming more aware. Thus by implementing this reflective tool in our lives we can maintain ourselves, change ourselves, our carbon footprint, and our world.

605. **The Archive: learning through video computer systems**

Submission Type: Exhibit/Presentation
Submission Category: Arts

Author(s):
Arturo Camacho, Graduate

Faculty Mentor:
Owen Smith

Abstract:
Given our upgrade-based culture, technology is rapidly becoming disposable and valueless after it reaches its now short usable life. Since their comercial introduction in the 1970's, Systems such as video games, computer software and hardware have been discarded, under the misconception of not offering anything valuable or important to society; in summary, "a waste of time". Nowadays, we are dealing with several issues revolving around these systems such as improper disposal, social ignorance, and to the lack of attention to their development and direction, but yet we look at them with the same lens.
The Archive project poses early video computing systems as valuable learning and teaching tools, following the examples done by other countries and understanding their potential as instigators for curiosity at all ages. "Obsolete" systems offer an invaluable look to the history of our technology advancements and their importance in retrospect which will also help the learning generation appreciate and better understand the direction and challenges that current technology might offer. Also, their simplistic platforms and hardware are simple enough for a first time student to understand and work with but complex enough to allow the student to jump to the next thing.
For the graduate symposium, The Archive will present three case studies (two of them encountered in Maine) as examples of the potential this approach has. The case studies include, devices and platforms currently used in other developed countries as teaching tools, examples of an artifact's agency and preservation after their usable lifetime, results of a self-taught based experience involving obsolete media, among others.

606. **Exploring Interpersonal Relationship Structures Through Sound**

Submission Type: Exhibit/Presentation
Submission Category: Arts

Author(s):
Katarina Hoeger, Graduate

Faculty Mentor:
Owen Smith

Abstract:
This submission presents a method of exploring interpersonal relationship structures using non-traditional modeling techniques. A non-traditional approach provides the projects the public with a secondary way to consider the impacts of their actions on personal relationship networks. The investigator uses multiple media in the approach. Mathematical concepts are used to create and test the system used to explore the relations. System perturbations and alternative network compositions and transition rates are explored. Sounds are used to create an experience for the public to experience the results of the investigation for themselves. The investigator draws upon personal relationships to create the model. The investigation yields no definitive results, allowing the public to extrapolate from the case provided and consider how they themselves might impact their personal relationship networks.

Social Sciences and Humanities

Projects 701 - 764

Social Sciences and Humanities

701. **Maine: Municipal Environmental Policy Diffusion and Preemption Policies**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Dalton Bouchles, Undergraduate

Faculty Mentor:
Timothy Waring

Abstract:
Environmental policy diffusion occurs at all levels of government. While extensive research has been conducted on state, federal and international governmental policy diffusion, little research has focused on municipality environmental policy diffusion because it is difficult to get information from some municipalities due to their small size. At the same time, states can enact preemptive policies, blocking municipalities from adopting certain ordinances. This halts all policy diffusion within the state. One example is states have enacted preemption preventing towns from adopting plastic bag bans or fees ordinances.

Once the data was collected about the three environmental ordinances, regression analysis using R Studio was conducted. The independent variables that were tested were: 1) Population, 2) Coastal, 3) Governmental Setup (split into four different types) and 4) The distance from the focal town to the closest town that has adopted the policy. Results show that being a coastal community has slight significance, but the distance variable showed the best significance out of all of the independent variables. Further research should be conducted to evaluate environmental policy diffusion across the entire state in order to determine the exact independent variables that explain, statistically, the diffusion. Preemptive policies must be reevaluated every three years to allow for regime change in order to prevent further blockage of environmental policy diffusion.

702. **Testing the Waters of Natural Resource Management: A study on the management values of Acadia National Park's key stakeholders**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Dominique DiSpirito, Undergraduate

Faculty Mentor:
Katharine Ruskin

Abstract:
National parks are socio-ecological systems managed with the intention of preserving natural resources and serving diverse stakeholders. The variety of stakeholder values poses a significant challenge to the management of resources within the protected lands.
Water resources in Acadia National Park (ANP) epitomize this dilemma due to the complex set of uses and jurisdictions present. I propose to investigate the management strategies valued by stakeholders through intercept surveys of local residents, natural resource managers, and ANP visitors. I will test whether there is consensus among stakeholder groups regarding the time frame on which water resources should be managed and the degrees of use permitted. Finally, I will compare the observed stakeholder values to the existing policies that govern ANP's water resources. Results will provide natural resource managers of ANP with much-needed insight into policies that may resolve points of contention among stakeholders.

703. **Adolescent Depression, Co-rumination, and Friendship: A Longitudinal Study**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Raegan V. Harrington, Undergraduate

Faculty Mentor:
Rebecca Schwartz-Mette

Abstract:
During adolescence, youth are increasingly influenced by friends and navigate increased risk for emotional problems. Interpersonal theories of psychopathology posit interpersonal interactions during this period may exacerbate risk for depression (Coyne, 1976). One example is co-rumination (Rose, 2002), a conversational process marked by excessive negative problem talk. Co-rumination has socioemotional tradeoffs, linked to increased positive friendship quality and increased depressive symptoms concurrently and over time (Rose et al., 2007; Rose et al., 2014). Past research utilized only two assessments (e.g., Rose et al., 2007; Starr & Davila, 2009), making the longer-term implications of co-rumination unclear. This study examined adolescents'

co-rumination, positive friendship quality, and depressive symptoms over 3 time points, each spaced about 3 months apart. Adolescents were recruited from local areas (N = 186). A cross-lagged panel model tested associations of the 3 variables over the 3 time points. Co-rumination was linked to increased depression and friendship quality at Time 1 but did not predict these variables over time. Instead, a cyclical association was observed where lower positive friendship quality at Time 1 predicted increased Time 2 depressive symptoms, which then predicted decreased Time 3 friendship quality. Results suggest lower levels of initial friendship quality may predict a downward spiral of increased depressive symptoms and friendship problems.

704. **Telemental Health Care from the Perspective of Maine Mental Health Professionals**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Lindsey Lagerstrom, Undergraduate

Faculty Mentor:
Fayeza Ahmed

Abstract:
Despite the rise in recent movements to shed light on the importance of mental health care in America, less than half of those with a diagnosed mental illness receive any treatment (Pradhan, 2019). For those who live in rural communities, access to mental health services is most likely limited and, as a result of treatment disparities, poorer outcomes occur more often (Myers, 2019). Telemental health, videoconferencing with a mental health professional for assessment and psychotherapeutic utility, has been proposed as a possible solution to the challenges of accessing care in the rural US. There is evidence of better medication adherence, symptom management and a reduced amount of hospitalizations (Hilty, 2013). However, it is under utilized across the mental health field (Ralson, 2018). This paper will specifically focus on Maine, as it is a mostly rural state and often suffers from a limited number of clinicians, hospitals specializing in mental health care, and poverty (rtorg, 2019). To understand the strengths, barriers and scope of telemental health, this project examines telemental health care from the perspective of mental health professionals in Maine. Data collection is still in progress and descriptive analyses (e.g., mean, frequency) of the participants' responses in order to characterize the issues facing mental health providers in Maine who do and do not provide telemental health services will be completed by April.
Acknowledgements: This project was funded by the Center for Undergraduate Research (CUGR) and the Maine Space Grant Consortium (MSGC).

705. **Emerging Neuroimaging Technology in Category Learning Research**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Sahvannah Michaud, Undergraduate
Rose Deng
Renee Savoie
Shawn W. Ell

Faculty Mentor:
Shawn W. Ell

Abstract:
Understanding the neural processes involved with learning and behavior is one central goal of cognitive psychology. One such method to accomplish this is through category learning, which is the ability to accurately sort objects and events into separate categories in order to appropriately interact and respond to our environments. How categories are learned and the neural processes involved with learning are currently debated as different types of category learning tasks are thought to engage different areas of the brain. To assess this, participants completed a series of category learning tasks while wearing a functional near-infrared spectroscopy device, which was used to assess changes in blood-oxygen levels in the prefrontal brain region. The task comprised of different category stimuli, which participants had to sort into either “category A” or “category B”, followed by corrective feedback. Neural activity within the prefrontal cortex was monitored throughout the task and correlated with participants’ performance across different category learning tasks.
Acknowledgements: This project was financially sponsored by a fellowship award from the Center for Undergraduate Research (CUGR) and the Maine Space Grant Consortium (MSGC).

706. **Influence of Personality on Dementia Caregiver Stress**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Michelle Ward, Undergraduate

Faculty Mentor:
Fayeza Ahmed

Abstract:
The number of Americans living with dementia is expected to rise from 5.8 million now to 14 million by 2050, which means the number of caregivers needed will also increase. In 2018, informal dementia caregivers provided 18.5 billion hours of unpaid care, which is valued at 284 billion dollars[1]. Along with the large economic impact this has on the country, it also has an emotional and physical burden on caregivers. Dementia caregivers typically experience a higher level of stress than other caregivers, but few studies have examined which individual differences may impact this stress[2,3]. One of these individual differences is personality, which is best captured under the Five-Factor Model (FFM), a well-supported theory that all personalities encompass five domains measured on a continuum: openness, conscientiousness, extraversion, agreeableness, and neuroticism[4]. The current study aims to examine the influence of personality on the level of stress dementia caregivers in Maine may experience. An increase in knowledge about dementia caregiver personality traits will help identify who is most at risk for burnout and allow for future research on personality-specific interventions. Results are forthcoming, as data collection is still in progress and the analysis will be completed by April.
Acknowledgments: $1,100 CUGR Academic Year 2019-20 Fellowship
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707. **How Families Experience and Cope With Acts of Violence and Victimization by a Family Member with a Severe Mental Illness**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Kati Morneault, Undergraduate

Delaney Woodward
Sophie Fortunato
Kalista Rattray
Taylor Courtois
Sage Scheffler

Faculty Mentor:
Karyn Sporer

Abstract:
The research that is the basis of this proposal examines the experiences of family members living with an individual with severe mental illness who exhibit violent behaviors. Specifically, the purpose of this research is to understand how families experience and respond to acts of violence and victimization by a family member with a severe mental illness. Data from in-depth, ethnographic interviews with 42 self-identified parents and siblings of violent individuals with mental illness were analyzed using grounded theory. Findings suggest that family members who experience continued violence by this individual introduced protective behaviors into their routine. In response to this violence, the family members implemented formal and informal protective behaviors. Specifically, this research focuses on two main themes: (1) Violence and victimization (i.e description of witnessed and experienced violence and victimization including sights, sounds, feelings, injuries, etc.); (2) protective factors and behaviors with sub-themes of formal and informal actions. The research concludes with recommendations for mental health practitioners, family intervention specialists, and group homes.

708. **Socioeconomic Status in Relation to Oral Reading Recognition**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Kaitlyn Nadeau, Undergraduate
Taylor Williams
Erika Pacheco
Taylor McMillan
Fayeza Ahmed

Faculty Mentor:
Fayeza Ahmed

Abstract:
Research has shown that academic achievement has a medium to strong relationship with socioeconomic status (SES) [1]. The family SES not only provides direct resources in the home, but can also indirectly impact factors outside the home, such as the kind of school one attends, the environment, and inevitably one's academic achievement [1]. In this current study, we aimed to examine how one's self-reported familial SES impacts their oral reading recognition scores. We used the Toolbox Oral Reading Recognition Test (TORRT) to measure this [2]. This is because oral reading has been shown to be strongly associated with quality of education, and quality of education is very much related to one's SES [3]. Undergraduate students at the University of Maine reported their SES and participated in a series of cognitive measures, including the TORRT. Data analysis is in progress, as we are continuing to collect data.

Acknowledgements: This project is part of a larger study in the faculty mentor's lab.

709. **Exploring the Marginalized Voice: Queering Form in Contemporary Short Fiction**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Maddy Jackson, Undergraduate

Faculty Mentor:
Jennie Woodard

Abstract:
Feminist and queer narrative theory calls into question the systemic way of thinking about categorizations such as genre conventions, form, and length. The short story subverts all of these, flipping common love plots or hero arcs, denying readers whole pictures, and even privileging plot over character development. Through the application of feminist and queer narrative theory, this study evaluates Lambda Literary Award-winning texts from authors Chinelo Okparanta, Krystal Smith, and Carmen Maria Machado on how the function, form, and common conventions of the short story are subversive in nature and lend themselves to the functions, forms, and conventions of the queer narrative. Thus, the research explores how the subversive nature of the short story may parallel the subversive nature of feminist and queer theory and acknowledges the gaps in the publishing of, the recognition of, and the overall academic revere of the short story art form.

710. **Examining the Relationship Between Interpersonal Accuracy and Group Involvement**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Vasiliqi Turlla, Undergraduate
Morgan Stosic
Jessica Correale
Mollie Ruben

Faculty Mentor:
Mollie Ruben

Abstract:
The ability to accurately interpret others' nonverbal behavior, known as interpersonal accuracy, is an essential skill for successful interactions with others. However, little is known about what social factors predict accuracy. It is possible that the more groups an individual is involved in, the more practice and feedback they receive regarding their perceptions of others behavior, which should foster greater accuracy. The purpose of the current study is to examine whether and how different types of group involvement (among undergraduate students) predicts interpersonal accuracy using two standardized, objective tests and a self-report measure. We hypothesize that membership in more extracurricular activities (i.e., groups) will predict higher interpersonal accuracy scores across all three measures of interpersonal accuracy. Participants (N = 410) were recruited from the introductory psychology participant pool. Exploratory analyses examined whether membership in different types of groups as well as leadership roles moderated the relationship with interpersonal accuracy. Results suggest that participants who indicated membership in more extracurricular groups scored significantly higher on three measures of interpersonal accuracy. Given that the causal direction of this relationship is unclear, future research will examine whether increasing interpersonal accuracy may subsequently increase involvement and likewise, whether becoming more involved (or increasing social interaction) increases interpersonal accuracy.

711. **Analyzing the Economic Impact of Entrepreneurial and Innovative activities of Alumni**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jacob R. LeLievre, Undergraduate

Faculty Mentor:
Philip Trostel

Abstract:
Undoubtedly, universities have a positive financial impact on the U.S. economy. This effect, excluding things like research and public service, can be largely attributed to graduates. This research focuses on quantifying the innovative and entrepreneurial impacts of alumni and their effect on the economy. This research reviews recent economic impact studies (EIS) from different universities and colleges concerning the economic impacts of alumni. Some of this research focuses on small business creation and innovation to quantify their estimated value-added to the economy through their alumni. The goal of this paper is to create a cumulation of reports for universities completing an EIS. By cross comparing different methods, this paper reviews the different ways in which institutions quantify the effects of alumni on the U.S. economy.

712. **Participation in the Belt and Road Initiative: Who Joins and Why**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Patrick Groening, Undergraduate

Faculty Mentor:
Kristin Vekasi

Abstract:
The Belt and Road Initiative (BRI) is a large-scale, global infrastructure project introduced by Chinese President Xi Jinping in 2013. The primary goal is to invest in infrastructure projects across Eurasia and Africa in an effort to improve regional connectivity. This research explains who participates in the BRI through cross-country quantitative analysis and two in-depth qualitative case studies. Through a logit analysis of political economy factors such as GDP per capita, FDI inflows, aid data, and others, I find that economic need is a significant predictor of membership, while aid tells a more complicated story. Two case studies into prominent BRI members – Kazakhstan and Italy – explore why different countries decide to participate, and the economic benefits and political controversies following that decision. Kazakhstan was the first

official member of the initiative and was where Chinese President Xi Jinping announced the commencement of the BRI's overland section. Italy joined in 2019 and was the first of the G7, and largest EU economy, to join. Overall, this project will allow for an understanding of why so many nations are joining the BRI and what participation signifies. This analysis is important due to the complex nature of the BRI and the varying responses and impacts it has generated worldwide, including immense criticism within the United States and many of their allies.

713. **The Richness of Diversity in Human Groups**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Olivia Eckert, Undergraduate
Marissa A. Donovan

Faculty Mentor:
Stephen Gilson

Abstract:
The University of Maine Diversity Leadership Institute defines diversity as "discrimination, racism, privilege, prejudice, and stereotyping" And while these experiences cannot be diminished, what is often overlooked is the richness of diversity and human difference within these groups. To move beyond essentialism, a course-wide inquiry was conducted to examine parts of diversity that yield analysis of within-group as well as between group differences. Group identity was only established prior to the interview, thereby allowing the data collected to be targeted to individual difference and preference.
Using open-ended, naturalistic methods, each student recruited and interviewed an adult over the age of 18 from one of the vulnerable population categories (e.g. racial minority, indigenous population, non-binary gender identity, disability, and ethnic minority).
The following questions served as guides for the open ended interview:

Tell me about your average day during the week and on the weekend
What are your preferences for recreation? food, music, film, viewing?
What are your health care and religious beliefs/practices?
What languages do you speak?
Interviews were analyzed using thematic analysis. The data revealed within group differences in all areas discussed. Moreover, between group similarities, often overlooked in the diversity

literature emerged as an important finding. We provide visual and narrative exemplars of the findings and themes as the basis to inform progressive diversity and inclusion theory and action.

714. **Out of Darkness: A Critical Review and Original Poetry Manuscript**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Bria Lamonica, Undergraduate

Faculty Mentor:
Jennifer Moxley

Abstract:
This proposed project is a collection of poetic works related to young women and the oppression they face in the 21st century as well as a discussion about how poetry can be used to challenge social norms and patriarchal values.One outlet or medium that has been historically relied on to release the frustrations and feelings that women face while striving and pushing for change has been writing, and more specifically poetry. Although this may be true, there is still much work to be done in the ways of expressing and highlighting the hardships that contemporary women face in day-to-day encounters, relationships, and life. Reflecting on and diving into the lives of oppressed young women in today's society, my collection of poetry sheds light on the everyday injustices and instances of oppression that are experienced by women living in America and all over the world. These ideas are relevant and constantly developing because of the need for honesty, fairness, and equal opportunities for women in areas such as academia, politics, education, and society in general. Questions like, "How do these instances shape who I am as a woman?", and "Will this stay with me throughout my life and impact how I view myself as a woman?", help to inspire a passion for exposing the truth and being an advocate that allows women's voices to be heard through writing. Through my research, and the crafting of contemporary free verse poetry, I expect to have the basis for creating a piece of art that is unique and powerful, and I will continue to be inspired by women poets like Anne Sexton, Adrienne Rich, and others who made sure their voices were heard.

715. **Implications of the Protest Paradigm on Marginalized Communities: Examining the Portrayal of Social Justice Movements in Mass Media**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Leela Stockley, Undergraduate

Faculty Mentor:
Beth Staples

Abstract:
This research project seeks to examine the impact of the “protest paradigm,” a communications theory, on social justice movements organized by marginalized communities. The protest paradigm is a journalistic approach which acts as a standard for creating protest stories which has been naturalized through the process of journalistic socialization. The protest paradigm relies on five major aspects; the framing of stories, reliance on official sources, invocation of public opinion, the delegitimization of the movement’s core values and the negative framing of major stakeholders through language choice. This research is based in the idea that marginalized communities are often disadvantaged within the American socio-economic system, and efforts taken to improve the situation of these communities are often framed in a way that damages the reputation of these community. The goal is to create a discussion about the way that journalists approach protest coverage, specifically protests led by marginalized groups, and highlight ways in which the protest paradigm can be used to create a framework that represents marginalized communities in an equitable way. Throughout this research project, I will focus on three major ideas: (1) discussing the protest paradigm, and how it’s current stance in the field of journalism has impacts on marginalized communities, (2) three case studies of instances where protest movements led by marginalized communities have been negatively impacted by the protest paradigm and (3) addressing the root causes of journalistic socialization and ways in which the existing structure can be adapted in an equitable way. This research seeks to challenge the preexisting ideas around journalistic socialization. The research will be presented to the UMaine community in the fall of 2020.

716. **Nonverbal displays of shame in LGBTQ+ populations and their relationship with health outcomes**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Leigh Neptune, Undergraduate

Faculty Mentor:
Mollie Ruben

Abstract:
Lesbian, gay, bisexual, transgender, and queer (LGBTQ) individuals are a health-risk population that experience shame frequently in response to their marginalized position in society. However, no research has examined the power of nonverbal expressions of shame to predict health in this population. The purpose of the current research is to examine how behavioral displays of shame among LGBTQ individuals predict concurrent and future mental and physical health. LGBTQ participants were recruited for two waves of data collection. In Wave 1, participants (N=51) were video-recorded in the laboratory speaking about a time they revealed their sexual or gender identity and felt badly about it. Participants then completed measures of mental and physical health at Wave 1 and three months later at Wave 2. Trained coders watched the videos (without audio) and coded the degree of chest narrowed and shoulders slumped using a validated shame behavioral coding scheme. Multiple linear regressions were used to examine the independent role of nonverbal expressions of shame on health outcomes. We expected more nonverbal expressions of shame to predict poorer mental and physical health. While more expressions of shame were not significantly associated with current levels of anxiety, depression, or physical health status, shame was uniquely related to increased alcohol use, tobacco use, and all drug use. Additionally, a higher degree of shame was associated with increased suicidal ideation scores three months later. These results will impact healthcare practices working with at-risk individuals by increasing sensitivity to nonverbal behaviors that may signal prospective health risk.

717. **Nonacceptance of Emotions as a Mediator between Negative Problem Orientation and Depression**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jade Perry, Graduate
Melodie Godin
Lauren Briggs
Michelle Buffie

Faculty Mentor:
Douglas Nangle

Abstract:
Investigating how inability to accept one’s emotions and negative problem orientation (NPO) may impact depressive symptoms can help give us a better understanding of psychopathology

and its implications. NPO is a cognitive set in which a person may view life problems as threatening rather than challenging (Anderson, Goddard, and Powell, 2007). Additionally, non-acceptance of emotions, a component of emotion regulation, is the inability to accept one's own emotions (Gratz & Roemer, 2003). Both NPO and non-acceptance of emotions have been associated with depression. In the present study, we hypothesize that non-acceptance of emotions will mediate the relationship between NPO and depressive symptoms in young adults. Data was collected from a larger study at the University of Maine on social problem-solving. Participants included 367 undergraduate students between the ages of 18-25. Participants completed the Social Problem-Solving Inventory-Revised (SPSI-R), Difficulties in Emotion Regulation Scale (DERS), and the Center for Epidemiologic Studies Depression Scale-Revised (CESD-R). A mediation analysis via process v3.4 was used to investigate the indirect effects of NPO through non-acceptance of emotions on depressive symptoms. Results indicated NPO as a significant predictor of non-acceptance of emotions, $b = 0.40$, $SE = .031$, $p < .001$. Non-acceptance of emotions was a significant predictor of depressive symptoms, $b = 0.74$, $SE = .13$, $p < .001$. There was a significant indirect effect of NPO on depressive symptom severity through non-acceptance of emotions, $b = .30$, BCa CI [0.161, 0.449]. This indirect effect accounted for 16.20% of the variance, $b = .162$, BCa CI [0.089, 0.239]. Findings from this study suggest that the inability to accept one's emotions may enhance the relationship between one's negative approach towards problem-solving and depressive symptoms. With such high prevalence rates of depression, it is vital to identify underlying processes that may contribute to the development and maintenance of depression. These findings help to characterize the nuanced relationships between NPO, non-acceptance of emotions, and depressive symptomology and highlights the need for further investigation.

718. **Outlawry and Liminal Space in Gísli's Saga**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Sarah Penney, Undergraduate

Faculty Mentor:
Sarah Harlan-Haughey

Abstract:
This project analyzes an Icelandic Saga, Gísli Súrsson's Saga, with the aid of key readings in liminal space theory, medieval Christian philosophy, and The King's Two Bodies by Ernst Kantorowicz. Building on prior scholarship by Giorgio Agamben, William Ian Miller, and other

scholars of medieval outlawry, the project will focus on Gísli's symbolic status as a break from Iceland’s pagan background due to his liminal state, outlawry, apparent belief systems and values, and suggested relation to medieval Christian philosophy. Gísli is an outlier, but he is also a precursor to Iceland’s eventual conversion to Christianity because of his negotiation of boundaries, turn from paganism, and acceptance of his fate. Through Gísli, I argue the presence of a spiritual bridge within the presentation of Iceland’s conversion to Christianity. This argument is relevant to current issues regarding colliding ethnic backgrounds and the liminal space between people and ideas. It also furthers the study of Iceland’s sagas as examples of historical immigration narratives and texts of spiritual significance.

719. **Understanding Veteran Suicides: Differences in Combat Deployed and non-Combat Deployed Risk of Suicide**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Teagan LaPiere, Undergraduate

Faculty Mentor:
Mollie Ruben

Abstract:
Veterans of the U.S. Military are committing suicide at a significantly higher rate than the civilian population (Kang, et al., 2015). Previous research suggests that non-combat deployed individuals have significantly higher risk of suicide than their combat deployed counterparts (Kang, et al., 2015). However, to our knowledge little research has been done to shed light on the differences between combat deployed and non-combat deployed veterans or attempted to understand why non-combat deployed individuals are at a higher risk of suicide compared to combat deployed individuals. This study examined these differences by administering a survey containing measures about suicidal ideation and military identity to veterans who have and have not been combat deployed. Our findings show “military centrality,” or the extent to which the military is a central part of their identity, is positively correlated with suicidal ideation in non-combat deployed veterans, but not for combat deployed veterans. This suggests that healthcare professionals should consider the role of “warrior identity” as a potential screener for suicide risk among non-combat deployed veterans.

720. **Other Fish in the Sea: Black sea bass (Centropristis striata) and environmental change in the archaeological record**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Brianna Ballard, Undergraduate

Faculty Mentor:
Bonnie Newsom

Abstract:
For my research project, I explored the connection between archaeological fish remains and their implications for climate change studies about the warming of the Gulf of Maine. Specifically, I attempted to identify Black Sea Bass (Centropristis striata) within the faunal remains excavated from the Waterside Shell Midden (44-7) in Sorrento, Maine. My work contributes to the doctoral research of Sky Heller, who is studying faunal remains from the coast of Maine to examine the relationship between fish species present in archaeological shell middens dating from ca. 5,000 - 3,800 years ago and the climate of the Gulf of Maine. Her research tests the hypothesis that the Gulf was a warm water ecosystem that cooled at approximately 3800 radiocarbon years B.P. To contribute to this project, I will assist with identifying faunal remains collected by Heller from Waterside
There are four stages to my project: 1) Acquire a sample of Black Sea Bass - a warm water fish species that may have been present in the Gulf of Maine during the Late Archaic period - deflesh it, and prepare it for inclusion into the comparative collection of the Zooarchaeology Laboratory at the University of Maine; 2) compare this new specimen to samples from the Waterside site to determine if any of the remains match the defleshed fish; 3) draw conclusions based on the data collected and my comparative analysis; 4) and combine all of my evidence in a conclusive report. By completing these four steps, I will contribute to the ongoing paleoclimatic research at the University of Maine, and also expand my knowledge of zooarchaeological analysis.

721. **The Impact of Emotion Regulation on ADHD and Depression Symptoms in Emerging Adults**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Hannah Meidahl, Undergraduate

Faculty Mentor:
Douglas Nangle

Abstract:
The current study examines the connections between emotion regulation (ER), ADHD symptoms, and depressive symptoms. ER is the process that comprises one's ability to control emotional responses and is theorized to be an important component in the disorders of interest. This expands on findings from Seymour et al. (2012; 2014) that found that ER fully mediated the relationship between ADHD and depression by analyzing this connection in a population of emerging adults. Undergraduate students (N = 361) completed the Difficulties in Emotion Regulation Scale (DERS), the Adult ADHD Self-Report Scale (ASRS), and the Center for Epidemiological Studies of Depression Scale-Revised (CESD-R). Higher ADHD symptoms were associated with higher ER difficulties (r = 0.47, p < .001), higher ER difficulties were associated with higher depressive symptoms (r = 0.65, p < .001), and higher ADHD symptoms were associated with higher depressive symptoms (r = 0.49, p < .001). A mediation model was conducted which demonstrated a significant indirect effect of ADHD symptoms on depressive symptoms through ER, b = 0.35, 95% BCa CI [.24, .47]. This indirect effect accounted for 25% of the variance, b = 0.25, 95% BCA CI [.18, .33]. This suggests that higher ADHD symptoms lead to higher difficulties in ER, which in turn lead to higher depressive symptoms. This indirect relationship is important in understanding how these disorders interact. Importantly, it provides a target area of intervention, ER, which can be used to limit future comorbidity and ease distress in individuals that have both disorders.

722. **Test-Enhanced Nondeclarative Memory**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
QianYu Huo, Undergraduate
David Smith
Shawn Ell

Faculty Mentor:
Shawn Ell

Abstract:
The finding that testing enhances the retention of learned material relative to more passive study has typically been investigated using tasks dependent upon an explicit, declarative learning system. It is unclear if retrieval has similar retention benefits for tasks dependent upon an implicit, nondeclarative learning system. We report the results of an experiment investigating this issue using the word fragment completion task – a task argued to require either declarative or nondeclarative memory to complete, depending on the presented instructions. Participants were shown a series of words and asked to rate the words on how positive or negative the words were. In the declarative condition, participants were instructed to remember the words for a future test. In the nondeclarative condition, participants were not told to remember the words. Half of the words were restudied by rating an additional time. The other half were tested on by showing the participants an incomplete word fragment (example: “c_m_u_er” for the word “computer”) and asking them to complete the word. Memory of the words was evaluated using incomplete word fragments either immediately or 48 hours later. There was an accuracy advantage for the tested words both immediately after training and 48 hours after training relative to the studied words in both the declarative and nondeclarative memory conditions suggesting an overall benefit of testing. These results fill a critical gap in the literature and advance the field by further characterizing the conditions that promote retention.

723. **Expanding the Projection Imperial Power: The Synods of Aachen (816-819)**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Clifford Greco, Undergraduate

Faculty Mentor:
Joel Anderson

Abstract:
An important stage in Christian monastic reforms occurred in Aachen during the synods from 816-819 A.D. These meetings were brought about to bring uniformity and centralization to monastic practices found within the Frankish realm of Charlemagne’s son, Louis the Pious (d. 840). The reforms were initiated by the Emperor of the Carolingian Empire and guided by the reformist monk Benedict of Aniane (d. 821). Monastic dogma that was agreed upon included a drastic reinterpretation of the Rule of St. Benedict. Benedict of Aniane’s influence was evident within the synods. His monastic reforms were directed towards establishing stringent asceticism and Christian zeal. But it is also important to recognize the reforms regarding imperial oversight

of monasteries, which invested the emperor with near unquestionable authority. This led to mixed reactions from monasteries and the Roman Papacy. A majority of monastic communities embraced the benefits of security and dogmatic consistency offered by the empire. The Papacy greatly feared these reforms. Many in Rome believed that Louis the Pious was attempting to imitate the absolutist rule of the Byzantine Empire. Each actor within this situation committed distinct actions. Every action committed by either the imperial court, monastic communities, or the Roman Papacy demonstrated the intentions and consequences of the synods. This moment in the development of religious monasticism was significant as some of the reforms enacted were controversial. Still, the changes at the conclusion of the Synods of Aachen, were revolutionary to Western Christian monastic tradition as it placed monasticism within the influence of the emperor.

724. **Sleep and Evaluating the Proficiency of Emotion Regulation**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Evan Vidas, Undergraduate
Colin Bosma
Emily Haigh

Faculty Mentor:
Emily Haigh

Abstract:
Sleep loss is a key factor in the diagnosis and treatment of mental illnesses (American Psychiatric Association, 2013). Sleep disturbance is associated with deficits in emotion regulation (Banks et al., 2007), or the ability to manage and respond to emotional experiences. The strong association between sleep issues and mood disorders (Palmer et al., 2016) may be explained by emotion regulation deficits. Research is needed to understand how sleep quality impacts emotion regulation in naturalistic settings. The present research will evaluate the relationship between trait and daily sleep quality and changes in emotion over time. Sixty participants are recruited as part of a larger study. Participants will complete the Pittsburgh Sleep Quality Index (PSQI) and complete surveys via a mobile app assessing sleep within the current circadian cycle, and state affect twice daily. Preliminary analyses (n=25) have been conducted to examine whether sleep quality and sleep duration predict negative or positive affect as measured by the Visual Analog Scale (VAS). While no association was found this may be related to small sample size. Additional analyses using the Positive and Negative Affect Scale, a more

comprehensive measure of state affect, will be conducted. Recommendations for future research will be discussed.

725. **Hip-Hop Attitudes and Mainstream Media**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Andrew Cashman, Undergraduate

Faculty Mentor:
Joline Blais

Abstract:
Hip-Hop music, commonly referred to as rap, is the most popular genre in commercial music, surpassing pop for the first time in 2019. The attitude that is expressed in mainstream hip-hop is representative of a stereotype. Most of the hip-hop music that is available through the radio or streaming and what reaches the most ears is often what is considered to be misogynistic, materialistic, and without a socially conscious message. Mainstream media has perpetuated an idea of 'whiteness,' or a white idea of what hip-hop should represent to express a homogeneous idea that is most marketable and appealing to a wide audience, whereas anti-racist or socially conscious music became less appealing.

The hip-hop "ethos" is accompanied by self worth (swag/drip) and the worth of the community, clout, intertextuality, and being in the realm of counter-culture is often overshadowed by the pro-cultural state of mainstream media and record labels, a factor that was not involved in the genre's inception. While the stereotypes of hip-hop's materialism, toxic masculinity, and lyrical content are still existing qualities within hip-hop culture, it is only a piece of a greater definition that is less seen by those who are less immersed in the culture. Hip-hop empowers those who are less privileged by creating a social identity that measures success through community goals, whereas mainstream media depicts success in hip-hop by fame and riches.

726. **The Impact of Stress on Category Learning Systems**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Anna Driscoll, Undergraduate
Rose Deng
Renee Savoie
Shawn Ell

Faculty Mentor:
Shawn Ell

Abstract:
The neurological response to stress has a variety of cognitive implications. This research examines the impact of stress on two competing cognitive systems. Depending on the nature of some cognitive task, individuals engage different systems that mediate their decision-making and performance. The hypothesis-testing system involves explicitly testing and applying various rules. The procedural-based system involves learning through implicit, incremental acquisition of information. Stress has been shown to impair cognitive processes that are critical for hypothesis-testing (i.e., working memory). This adverse effect, however, has not been observed in the context of procedural learning. In fact, there is evidence that suggests stress may enhance cognitive performance on procedural-based tasks. In order to investigate how stress interacts with these systems, we employ two cognitive tasks. We utilize a "rule-based" task, which is thought to promote hypothesis-testing and activates working memory. Contrastingly, the "information integration" task promotes incremental, associative learning (i.e., procedural learning). To effectively manipulate stress as a variable, we employ a cold pressor test (CPT) in addition to a social evaluative stressor. As a result of competing systems, we hypothesize the impact of stress will lead to enhanced results on the information-integration task, while impairing performance on the rule-based task. Although previous studies have yet to show this double dissociation, our experiment aims to investigate this relationship. Investigating the differential effects of stress on cognitive ability will provide insight into the existence of multiple learning systems as well as the neurological circuits that mediate stress.

727. **Speak Softly and Carry a Selfie-Stick: Understanding risk in selfie-behaviors at National Parks**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Olivia Reese, Undergraduate
Judith Rosenbaum-Andre

Faculty Mentor:
Judith Rosenbaum-Andre

Abstract:
Tourists who fall off a cliff, hikers who are rescued from near death due to hypothermia — injuries and deaths inside U.S. national parks are nothing new. What makes these two examples different from accidents in the past is that they were both the direct result of park visitors wanting to take a specific selfie. As Instagram continues to be one of the most popular social media platforms to date, we understand less and less about how the desire to share aesthetically pleasing photos could be affecting our better judgement. Are people aware of the risks they are willing to take for these photos? Are their followers? After scraping images hashtagged with one of the top 10 most visited national parks during peak visitation, the images were then analyzed for risky behaviors in accordance with the rules identified by the National Parks Association and Rickard (2014). Those displaying risky behaviors were identified and their comments analyzed using a grounded theory approach. Findings show most comments approve of the behavior, enjoy the imagery shown, and reference a personal relationship with the poster. Few comments recognize risk, and those few did so in a non-confrontational manner that is open to multiple interpretations. Results showed that commenters valued personal relationships with the poster over any risks the poster engaged in.

728. **Female Political Campaigns: Just The Right Amount of Femininity**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Harley Rogers, Undergraduate

Faculty Mentor:
Rachel Snell

Abstract:
This paper seeks to understand how female politicians develop their public identities to meet and reject gender stereotypes society holds of women. The case study will look at Margaret Chase Smith’s political career, with a particular focus on her 1964 presidential campaign. Analysis of Smith’s career through newspaper coverage will provide an understanding of Smith’s choices surrounding her public identity. This project relies on archival research of correspondence, newspaper clippings, and speech and interview transcripts provided by the Margaret Chase

Smith Library and Museum and other research databases. The purpose of this study is to identify ways that women respond to gender expectations while seeking positions historically held by men, to develop a better understanding of the additional obstacles female politicians must jump through when running for elected office. A better understanding of the challenges that gender expectations imposed on women, specifically on those seeking positions in public office, will provide a first step in alleviating these additional barriers on future female political candidates.

729. **Sexual Consent Education: A Content Analysis of Eight Programs**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Caley Godino, Undergraduate
Morgan Lynch
Sarah Pett
Kathleen Castillo-Ruano

Faculty Mentor:
Sandra Caron

Abstract:
With the rise of the #MeToo movement there has been greater recognition of the need for sexual consent education. To date, 21 states have mandated sexual consent education. However, there is little research on what sexual consent looks like or includes. This study involved a content analysis of eight sexual consent education programs for high school teenagers. Each curriculum was examined for how “sexual consent” is defined, the goals and objectives of the programs, and the types of activities included in the programs. Comparisons across programs were made. The findings of this content analysis revealed many similarities and some differences. For example, sexual consent education is similarly defined across all eight curriculum, with an emphasis on decision-making, respect, and the importance of communication. The goals across all eight programs were also similar in terms of focusing on helping students understand that sexual involvement is a choice. All programs use materials that involve group activities. The content analysis revealed that a common theme in sexual consent education is to focus on building students’ confidence and communication skills. Important differences in the content were also found and are discussed. Ultimately, sexual consent education is intended to reduce the number of sexual assaults. Future research is needed to determine if, based on their content, these programs actually lead to fewer assaults.

730. **Do Consumers with Chronic Diseases Modify Their Consumption of High-Value Drugs When Other Care Becomes More Expensive?**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Daniel Feldman, Graduate
Angela Daley
Keith Evans
Caroline Noblet

Faculty Mentor:
Angela Daley

Abstract:
The US spends 17.9% of its GDP on healthcare, the highest of any OECD nation despite average mortality rates for ischemic heart disease and diabetes. Prior work largely concludes that consumers with these two types of chronic diseases reduce their consumption of drugs when faced with higher cost-sharing. The literature also explores “spillover effects” where a price change for one type of healthcare affects the utilization of another. There is widespread, although not unanimous agreement that when drugs that treat chronic conditions become more expensive, consumers substitute into other, sometimes more costly forms of healthcare, such as physician office visits and inpatient care. We take a different approach to determine whether this substitute relationship also holds in the other direction. Using longitudinal claims data from a large employer in the Northeast United States, we explore the impact of a change in the price of medical care on the consumption of high-value drugs and outpatient office visits, holding drug prices constant. We find that an increase in the price of medical care has a negligible effect on the consumption of office visits for people with hyperlipidemia and diabetes. Furthermore, we find that consumers with high blood pressure and hyperlipidemia reduce expenditure on drugs, but do not lower the quantity consumed. We cannot conclude, therefore, that the substitution relationship between high-value drugs and other health care is bidirectional.

731. **The Effects of Sex Education on Healthy Sex Relationships**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Dayle Welch, Graduate
Anna Godsey
Aleigh Suffern
Karah Hussey

Faculty Mentor:
Daniel Puhlman

Abstract:
Several studies have been conducted to examine the association between types of sex education and contraceptive use. The two sexual education programs that are typically taught in schools are Abstinence Only Education (AOE) and Comprehensive Sex Education (CSE). To reach clarity on the benefits of sex education and it's effect on adolescent healthy choices in relation to sex, this study took a look at the difference between these educations, and their impact on adolescent and young adults future choices regarding sex. Data was collected via self administered online surveys from 270 university students, male and female aged 18-30. Bivariate and multivariate analyses were conducted using SPSS software. Participants were asked to report about their potential use of different types of contraceptives and whether or not they felt that their sex education prepared them for future healthy sex lives. These students were also examined for: age at start of sex education; where they received their sex education; what type of education they received; and type, frequency and comfort of using the following contraceptive methods: condoms, birth control pill, IUD, Nexplanon, other and/or none. Students who reported receiving CSE were likely to also report that they also use or have used contraceptives. Results indicated that individuals who receive a more comprehensive sex education are not anymore likely to practice healthy sex choices than those who received abstinence only education.

732. **Language Indicating Sadness During Problem-Talk Moderates the Association Between Co-Rumination and Depression in Adolescents**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Emily Scarpulla, Graduate
Helen Day
Cynthia Erdley

Faculty Mentor:
Cynthia Erdley

Abstract:
Co-rumination refers to discussing problems with another person in a symptom-focused manner and has been shown to predict depressive symptoms. A separate body of literature has investigated the relationship between language use and depression. While studies have investigated different aspects of co-rumination that predict depression, no study has examined how descriptive language during co-rumination relates to depressive symptoms. Using sad language during problem-focused conversation may exacerbate the negative feelings experienced in co-rumination, leading to a higher likelihood of depressive symptoms. Thus, the current study examines the relationship among language, co-rumination, and depression in adolescents. A total of 176 undergraduate students were asked to each recall a personal problem, and then with a friend, had 16 minutes to discuss each problem. Participants were also asked to complete a self-report measure of depressive symptoms and engagement in co-rumination. Using transcripts from the conversations between the dyads, text analyses were run with a validated dictionary of "sad" words to find the percentage used in discussion. A moderation was run to examine how sad language usage influences the relationship between co-rumination and depression. Results indicated that at higher rates of sad language usage, co-rumination predicted depression in adolescents ($p < .001$).

733. **Terms of Erasure: An Exploration of the Jewish Experience**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jessica Sweeney, Undergraduate

Faculty Mentor:
Karyn Sporer

Abstract:
Throughout history, Jewish American have and continue to be persecuted for their religion and ethnic identity. Anti-Semitism has been a rising problem in recent years, and I seek to understand how this national issue affects individuals in a rural community in New England. More broadly, I want to understand how Jews in a rural community in New England experience anti-Semitism and micro-aggressions. To conduct this research, I will conduct interviews in the region. The

purpose of this research is to understand the Jewish experience in a rural community in order appropriately address the issue of anti-Semitism.

734. **Media Coverage on School Shootings: An Analysis of Headlines Over the Past 20 Years**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Rachel Davidson, Undergraduate
Emily Clarke
Molly Foran
Madison Tatten

Faculty Mentor:
Sandra L. Caron

Abstract:
School shootings have reached epidemic proportions. The Columbine High School shooting April 20, 1999 is commonly referred to as the beginning of the school shooting epidemic. Since Columbine, there have been over 270 school shootings in the United States. And while 20 years ago school shootings occurred a few times a year, in more recent years they are occurring a few times a month. In fact, half of the 270 school shootings occurred just in the last five years. Media coverage of these events has been extensive. However, little research has examined the ways in which these school shootings are presented and described by the media. This study involved a content analysis of headlines describing school shootings over the past 20 years. Specifically, the headlines by five major media outlets (ABC News, Fox News, CBS News, CNN, and The New York Times) were analyzed for common themes and trends across 20 years. Results revealed a number of interesting themes including headlines' discussion of the gender of the shooter, number of injured or killed, and the use of synonyms other than shooting. Trends across time in the way media headlines describe school shootings were also found. For example, over 20 years, there has been an increased focus on the shooter over the victims. Implications of the findings of this content analysis will be discussed.

735. **How do Homeless Youth Find Resources on Social Media?**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Braden Beauregard, Undergraduate
Abigail Wingard
Sarah Duffin
Tim Florio

Faculty Mentor:
Sandra L Caron

Abstract:
Homelessness affects about one in ten youth ages 18-25 and one in thirty youth ages 13-17 in the United States. Research shows that youth experiencing homelessness still have significant access to cell phones and social media. For example, one study found two-thirds of homeless youth have a cell phone. Another study found 90% use Facebook regularly , and 93% use technology weekly. This experiential research examined how easy or accessible it might be for homeless youth to find resources through social media. The study involved searching Facebook, Twitter, Instagram, websites on the Internet, and apps to find resources: shelter, food, services, and support. Four states were chosen: Colorado, Florida, Massachusetts, and New York. Social media outlets were searched for two cities in each state. Findings revealed that the use of social media is not always a good way for homeless youth to find resources. Specifically, Facebook, Instagram and Twitter were least effective for finding programs for assisting homeless youth. Apps provided the best resources for young people looking for shelter, food, health care. Implications are discussed for improving social media as a resource for homeless youth.

736. **A Content Analysis of Reader Comments: Common Misconceptions about DACA (Deferred Action for Childhood Arrivals)**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Shannon Stewart, Undergraduate
Cynthia Putnam
Vendula Pribylova

Chloe McIntosh

Faculty Mentor:
Sandra L Caron

Abstract:
This study was a content-analysis of the most common misconceptions found in public responses to news articles on DACA since it was first implemented by President Obama in 2012. DACA views have shifted to be more negative since the program was first implemented. For example, President Trump has threatened to remove DACA, putting the lives of over 700,000 individuals at a risk. This research study analyzed people's comments from news articles about DACA (in newspapers and on social media sites) focusing specifically on those comments that were misconceptions. One news article and one social media article per year was examined beginning in 2012 when DACA was first administered to the present day (2019). For each of the 18 articles, the first 20 comments containing misconceptions were collected for inclusion in the analysis. The 360 comments were then coded into common themes. The findings revealed that the most common misconceptions about DACA are in four areas: 1) expenses, 2) crime, 3) legal status, and 4) benefits that come with DACA. These findings point to the need for greater education in these four areas in order for people to understand the facts and to be able to make informed decisions on DACA.

737. **Effectiveness of Behavior Programs in Public Schools**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jamie Sprague, Graduate

Faculty Mentor:
Elizabeth Depoy

Abstract:
A developing intervention to support students who have behavioral concerns within public school systems is currently emerging. Due to the increased number of students who lack the skills necessary to achieve success behaviorally during the school day, public schools have adapted behavioral treatment interventions into students school experience. Evidence and strengths-based approaches have been implemented within public schools to assist students in reducing maladaptive behaviors. Literature that examines the effectiveness of behavior programs

within public school settings suggests that students who enter public schools with diagnoses related to behavior concerns, students who present behavior concerns without diagnoses and students who consistently lack basic needs are at an increased risk of engaging in behaviors incompatible with their learning, and interfere with the learning of their peers. The research to be presented in this poster examines the outcomes over a year of students who have been enrolled and completed a behavioral program at an elementary School in southern Maine. The outcomes variables; students' ability to maintain adherence to the school's guiding principles; be responsible, be safe, and respectful were measured in extant data recorded by program staff during the 2016-2017 academic year. Literature and methods will be detailed and findings from evaluative investigation research including successes and barriers specific to the measured variables will be displayed. Conclusions will propose future research and revisions informed by this inquiry.

738. **Self-Reported Barriers to Screening Mammography in Women over Fifty**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jennifer Gasaway, Graduate

Faculty Mentor:
Patricia Poirier

Abstract:
Non-modifiable risk factors for breast cancer include age and gender as older women pose the strongest risk for a diagnosis of invasive breast cancer followed by inherited mutations, personal or family history of breast or ovarian cancer, atypical hyperplasia of the breast, high dose radiation to the chest wall at a young age, early menses with late menopause, not having children until after the age of thirty, high levels of sex hormones, and recent use of oral contraceptives (American Cancer Society [ACS], 2019). Modifiable risk factors for breast cancer are weight gain after the age of eighteen, obesity, use of menopausal hormones, alcohol consumption, and physical inactivity (ACS, 2019). Nationally recognized institutions, cancer foundations, health care institutions, and advocacy groups indorse mammography screening for early detection of invasive breast cancer. Yet, almost 30% of women in the United States who are 50 and over and of average risk for breast cancer are not screening with mammography. Health literacy, health care provider recommendation, and social determinants of health are identified barriers discussed in the review of the literature. Synthesis of the literature brings attention to the Affordable Care Act and Medicaid expansion, as well as clinical application for the Advanced Practice Nurse

using the Health Belief Model to address perceived susceptibility, perceived benefit, and perceived severity to public health screening with mammography.
Key Words: breast cancer, screening mammography, cancer screening, health belief model, advanced practice nurse, social determinates of health, barriers, never screened

739. **Understanding Substance Use Stigma in the Employment Sector**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Abby Frutchey, Graduate

Faculty Mentor:
Elizabeth DePoy

Abstract:
According to the Substance Abuse and Mental Health Services Administration (2019) there are approximately 22 million Americans over the age of 12 impacted by substance use disorder and additionally another 23 million Americans who report being in recovery from substance use currently. This represents a large part of the working population in our country. With increased efforts to curb stigma related to substance use disorder, research regarding the attitudes of employers towards substance use disorder can shine a light on the barriers this population faces when seeking work. Based on the literature review, it is theorized that individuals with former and current substance use disorder face significantly higher levels of stigma within the employment sector, than those who do not have substance use disorders. This study relying on an 8-question online survey will answer the following research questions:
1. To what degree is substance use related stigma present among employers?
2. What are the demographic correlates of stigma?
Year-round and seasonal small business owners in a rural Maine county comprise the sampling frame of small business employers in rural Maine.
The results will inform efforts to increase access to jobs that foster recovery, and contribute to economic well-being of individual workers and Maine. Identifying present perceptions of employers as it relates to substance use disorder, will aid in supporting recovery efforts and education.

740. **New Kid on the Block: El Niño-Modoki in Peru-Past, Present, and Future**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Heather Landazuri, Graduate
Daniel Sandweiss

Faculty Mentor:
Daniel Sandweiss

Abstract:
During the climatological phenomenon referred to as El Nino Modoki, warm sea surface temperatures (SSTs) in the central Pacific are flanked on the east and west by cooler SSTs. Over the last century, El Niño-Modoki has increased in frequency, but a long-term sequence has yet to be established prior to the last four centuries. At least on the north coast of Peru, El Niño-Modoki is associated with reduced river discharge resulting from lower precipitation and/or temperature in the adjacent Andes mountains. Much paleoclimatological and archaeological research has focused on the effects of canonical El Niño along the Peruvian coast, however, almost no attention has been paid to El Niño-Modoki in this region even though the associated reduction in water flow must have a major, recurring effect on the irrigation-based societies that inhabit the area. Considering the societal and environmental gravity of ENSO phenomena, improving our understanding of previous events is essential not only to anticipating them, but also to mitigating their effects on human populations. In this poster we present the paleoclimatological research potential of El Nino Modoki on the northern coast of Peru with specific focus on potential proxy sources, prehistoric adaptive strategies, and modern applications.

741. **How Rejection Sensitivity May Foster Less Satisfying Friendships: The Role of Retaliation and Withdrawal in Response to Perceived Rejection From Friends**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Laura Andrews, Graduate
Cynthia Erdley
Douglas Nangle

Faculty Mentor:
Cynthia Erdley

Abstract:
Rejection sensitivity (RS), the disposition to anxiously or angrily expect, readily perceive, and overreact to rejection, has been associated with reduced satisfaction in romantic relationships. To date, the literature has primarily investigated romantic relationships, leaving much unknown about late-adolescent friendships. RS individuals tend to withdraw or retaliate in an attempt to protect themselves from rejection. However, these responses likely contribute to relationship dysfunction and dissatisfaction. The current study examined the association between RS and friendship satisfaction in same-gender friendships and investigated whether these associations would be indirect via withdrawal and retribution. Method: Undergraduates completed self-report measures of RS, relationship satisfaction, and behavioral responses of withdrawal and retribution. Results: Mediation analyses conducted with PROCESS indicated that individuals high in anxious and angry RS were less satisfied with their friendships partly due to their tendency to withdrawal from and retaliate against friends. Conclusion: These results provide initial evidence of the detrimental effects of RS in late-adolescent friendships. Avoidant and retaliatory responses to rejection concerns in friendships appear to play a small yet important role in reducing relationship satisfaction. Future research may investigate whether RS similarly affects the friendship partners' satisfaction and whether this occurs indirectly though maladaptive behavioral responses. Longitudinal research is also needed to explore long-term outcomes, such as relationship dissolution.

742. **Perceived Stigma of Mental Health Preventing Law Enforcement Officers From Receiving Mental Health Assistance**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Melissa Macphee, Graduate
Mary Leaming

Faculty Mentor:
Elizabeth Depoy

Abstract:
Law enforcement officers experience chronic exposure to traumatic situations, acute stress, danger, violence, hazards, hostility, long rotating shifts, and remain in a constant state of

alertness for the entire duration of their career. The work that law enforcement officers do and the trauma they are exposed to has been shown to increase the risk of an officer developing symptoms of PTSD, which are associated with major depression, panic attacks, phobias, mania, substance abuse and increased risk of suicide. While multiple organizations and programs exist to assist law enforcement officers with mental health, the services are largely underutilized. There is some evidence stigma associated with service use is one of the major barriers to seeking help. Unfortunately, there is an insufficient body of research to measure and characterize service-related stigma, leaving a gap in evidence necessary to inform programs to promote mental health among LEOs. The purpose of this study is to discover the perceived barriers to mental health service use and unmet articulated needs by law enforcement officers. Through on-line survey methods, multiple law enforcement agencies and officers at the local, county, and state level are participating. The data will be used to guide law enforcement agencies in how best to revise and shape mental health services such that they are accepted, accessible and usable to officers who otherwise would not feel comfortable in using critically needed professional resources.

743. **Why Do Males Choose Social Work as a Career**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Zeus Markos, Graduate

Faculty Mentor:
Elizabeth Depoy

Abstract:
As of 2019, males comprise less than 20 percent of all social workers. Given this statistic, it is not surprising that the few studies which have investigated the factors that contribute to social work career decisions do not include men in their samples. Several trends create the need to examine gender differences in social work as career choice. First, given that the social work field is expecting a significant increase in employment over the next decade, it would behoove the social work field to better understand the reasons why males do or do not choose social work as a career as the basis for recruitment. Second, given the emphasis on diversity and inclusion, representing males within the profession is important in advancing this agenda. Third, increasing the representation of males within the profession allows role modeling for clients and a more nuanced challenge to stereotypical gendered career choices. In this study open-ended interview will be used to ascertain the complex reasons that male social work students chose the profession. Life history interview will examine the turnings and influences that led to male

students choosing this profession in which so few men are educated and employed. The results will be used to inform further research that can lead to recruitment and retention of all genders within the social work profession.

744. **LGBTQA+ Health Disparities in Maine**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Emma Brickman, Graduate
Caryn Boutaugh
Gabrielle Craig
Abigail Irvine
Avery Herzog

Faculty Mentor:
Elizabeth Armstrong

Abstract:
Research indicates the Lesbian, Gay, Bisexual, Transgender, Queer, Asexual + (LGBTQA+) community have high rates of unmet healthcare needs, leading to disparities in healthcare outcomes. Graduate student researchers at the School of Social Work partnered with Health Equity Alliance (HEAL) to investigate the unmet needs and healthcare disparities experienced by the Maine LGBTQA+ community.
This research team and HEAL developed an anonymous, web-based, 71 question, self-administered survey. Recruitment emails designed by this research team were sent to HEAL's Director of Finance and Operations, who sent these emails to all existing HEAL clients, allied organizations and their clients, and posted on HEAL's social media accounts. Surveys were collected from February 10th, 2020 to February 26th, 2020. Respondents could enter into a raffle to win 1 of 6 $75 Amazon gift cards.
130 survey responses were recorded. Respondents varied from 18 to over 65 and came from across 10 different counties in Maine. Nearly 40% of respondents felt they had experienced stigmatization, discrimination, or unkindness in a healthcare setting because of their LGBTQA+ identity, and nearly two-thirds felt Maine healthcare providers have moderate to low levels of knowledge about LGBTQA+ healthcare needs. Of participants with a primary care provider, nearly 80% indicated they were only somewhat comfortable or uncomfortable with that provider. Results indicate a need for future research on health disparities in the LGBTQA+ community in

rural areas of Maine. Findings show the need for additional training for healthcare providers on working with people in the LGBTQA+ community.

745. **Assessing Co-rumination about Romantic Experiences: An Initial Validation Study**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Jessica Shankman, Graduate
Eliot Fearey
Rebecca Schwartz-Mette

Faculty Mentor:
Rebecca Schwartz-Mette

Abstract:
Co-rumination (perseverative, negatively-oriented problem talk) is associated with positive friendship quality and risk for depressive symptoms, particularly among romantically-involved adolescent girls. Researchers have speculated that youth in romantic relationships may have more problems to co-ruminate (CR) about with friends, but this has not been examined. The current study (N=385; M age = 18.61; 70.9% female) assessed a revised version of the Co-Rumination Questionnaire developed to assess CR about romantic experiences (RCR) with friends. Participants completed self-report measures of depressive and anxiety symptoms, friendship closeness, CR and RCR, and (if applicable) romantic relationship quality. Correlations between all variables of interest were calculated for males and females separately. Results suggested that RCR and CR were strongly and significantly associated for both males and females. RCR was significantly and positively associated with anxiety symptoms for females and with friendship closeness for both males and females; all other associations were nonsignificant, whereas CR was associated with all variables of interest for females and only friendship closeness for males. Additionally, results from simple linear regression analyses suggested that negative romantic relationship quality significantly predicted CR but not RCR; all other variables predicted both CR and RCR. None of the associations were moderated by gender. This is the first study to assess RCR. RCR appears to have similar links to anxiety and depressive symptoms as well as friendship closeness as CR but only CR was associated with negative romantic relationship quality. Future studies should test this longitudinally, using observational methods, and younger adolescent samples.

746. **Implicit and Risk-Taking Attitudes and Their Temporal Relationship to Non-Suicidal Self-Injury**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Melissa Jankowski, Graduate
Cynthia Erdley

Faculty Mentor:
Cynthia Erdley

Abstract:
Non-suicidal self-injurious behaviors (NSSI; harming oneself without the intent to die) is a leading health concern with grave implications. Unfortunately, the identification of individuals who may be experiencing thoughts of self-injurious behaviors has relied solely on self-report. Self-report may be unreliable when probing thoughts and attitudes towards behaviors that individuals may be motivated to conceal, such as those regarding self-injurious behaviors. As such, use of computerized behavioral tasks may provide insight into identification of individuals who are most at risk for self-injurious behaviors. Two such tasks that may provide insight into those at the highest risk for self-injurious behaviors is the Self-Injury Implicit Association Test (SI-IAT; Nock & Banaji, 2007) and the Balloon Analogue Risk Task (BART; Lejuez et al., 2002).
This study sought to investigate whether (1) the SI-IAT could identify participants with histories of NSSI, (2) how implicit attitudes towards NSSI relate to engagement in the behavior, and (3) whether the addition of a computerized task of risk-taking (BART) could help identify those most at risk for self-injurious behaviors.
Results indicate that implicit association with NSSI alone may not be able to predict those at current risk for NSSI. The addition of a measure of risk taking, such as the BART, however, may provide incremental validity to the SI-IAT, especially for those who have most recently engaged in NSSI. Using computerized tasks such as the SI-IAT and the BART may be able to identify those at risk in ways that fixed, self-report risk factors may not.

747. **Practice Makes Pain Perception Perfect (Almost): Improving the Assessment of Other's Pain**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Morgan Stosic, Graduate
Jessica Correlae
Mollie Ruben

Faculty Mentor:
Mollie Ruben

Abstract:
In order to provide high-quality care to patients, physicians must be accurate in their assessments of patient's pain. However, both women and ethnic minorities tend to have their pain most frequently and substantially underestimated in medical care. The present research sought to mitigate this bias by assessing the effectiveness of three different types of feedback interventions on pain perception accuracy. Participants (N = 229) completed two pain perception tests comprised of clips of real people undergoing a laboratory pain procedure where the criterion was the target's self-reported pain (from 0-10). Participants completed the pre-test, were randomly assigned to an intervention condition, and subsequently completed the post-test. Results suggest that allowing participants the opportunity to practice perceiving pain with feedback regarding their accuracy was the most effective intervention in significantly improving pain assessment accuracy. However, because this intervention was as effective on white and male targets as it was on women and ethnic minority targets, this intervention did not necessarily reduce pain assessment bias. Implications suggest implementing training programs among caregivers which allow them the opportunity to practice pain perception with feedback. However, future research should seek to uncover interventions which both improve pain assessment accuracy, as well as mitigate bias.

748. **Kinship Care in Maine: The Licensure Process**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Caitlyn Dowd, Graduate
Jessie Dunson-Todd
Jackie Hilton
Nicholas Silver

Faculty Mentor:
Elizabeth Armstrong

Abstract:
Research indicates that children in the foster care system experience better outcomes when taken in by family members, known as kinship caregivers, as opposed to non-kinship caregivers. However, the literature indicates kinship caregivers face significant challenges in obtaining foster care licensure. We know little about how to improve the licensure process and how kinship families in Maine experience it. This study investigates perceived barriers to obtaining kinship foster licensure in Maine and the impact of a non-profit that works with foster and kinship families, Adoptive and Foster Families of Maine (AFFM). Semi-structured group interviews are undertaken with kinship families in Maine, recruited from the AFFM consumer community (n= 15). Our findings highlight difficulties kinship families face when assuming caretaking roles with young family members. Specifically, kinship families described lack of follow-up and updates on cancellation, redundancy in required paperwork, and delays in processing paperwork. Families also cited financial hardship, substance use disorder among biological parents, their own health challenges and a lack of education about community resources. Focus groups yielded positive feedback about AFFM's supportive efforts, such as connecting families to needed resources and assisting families with required paperwork. Our findings underscore the importance of the support offered by AFFM in the face of systemic failures described by both the literature and the interviewees. Policy makers are encouraged to advocate for increased funding for child protection agencies so that more case workers are hired, resulting in reasonable caseloads and time enough to more effectively work with kinship families.

749. **What Makes a Great Co-Parenting Program?: A Qualitative Examination of the Perspectives of Professionals**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Kittiya Reeves, Graduate
Emily Neville
Maylinda Boynton
Anna Caballero

Faculty Mentor:
Daniel Puhlman

Abstract:
This study aims to determine the most desired traits that should be included in a co-parenting program according to the perspectives of professionals who work with families. This study uses

qualitative data collected by face to face interviews with twelve professionals: therapists, lawyers, guardian ad litems and court appointed mediators. This study focuses on one question from the interview questions: “If you had a magic wand, what would the perfect co-parenting program look like?” in order to answer the research question: What makes a great co-parenting program according to the perspectives of professionals? This study found that a great co-parenting program consists of five important traits: mental health, intervention, frequency, financial/funding, and resources.

750. **Healing Trauma Through the Body: Case Studies of Clinicians and Yoga Instructors**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Bobbie Jo Benjamin, Graduate
Michelle Moschkau

Faculty Mentor:
Elizabeth DePoy

Abstract:
Awareness of the impact of psychological trauma on mind and body has only recently been brought to the forefront of the way the Western world shapes itself. Historically, “female hysteria’” or “shellshock” were monikers describing the phenomenon of a person suffering from symptoms of trauma. However, in 1980s a group of Vietnam veterans and psychoanalysts lobbied the American Psychiatric Association (APA) to descriptively and expansively rename these conditions within a larger rubric, Post-Traumatic Stress Disorder (PTSD). Treatment such as Cognitive Behavioral Therapy (CBT) and psychiatric medications are just some of the methods used to heal trauma. More recently, however, the need to include the body in any attempt to heal has been recognized. Thus, the body-based healing modalities such as yoga, breathing exercises, qigong, drumming, martial arts, and group singing and dancing, practiced for centuries in non-western contexts, have been brought to western interventions for trauma healing. This study utilizes a mixed method design to explore the nature, development of, and expected outcomes of trauma-informed body-based healing modalities. The purpose of this study is to learn how body-based healing modalities support healing of trauma, and to compare the variations in method and outcome among different types of practitioners. Information gathered in this study will increase awareness and knowledge of the use of body-based movement healing modalities comparing the differences in approaches between yoga instructors and licensed mental health clinicians.

751. **The Effects of Equine-Assisted Activities on a Youth with Developmental Disabilities**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Lesley Hanscom, Graduate
Jenna Joeckel
Ericka Saucier

Faculty Mentor:
Elizabeth DePoy

Abstract:
The broad term of “equine-assisted activities and therapies” (EAAT) is the activity of therapeutic horseback riding, which involves the teaching of specific riding skills to individuals with various disabilities (Rigby & Grandjean, 2016). According to Lyons (2012), therapeutic horseback riding may be associated with numerous benefits to the rider. The Centers for Disease Control and Prevention (CDC) (2019) define developmental disabilities as a group of conditions that can cause physical, learning, language, and/or behavioral impairments. Approximately one in six children in the United States have one or more developmental disabilities or developmental delays, which may have an impact on daily functioning and are generally a lifelong challenge (CDC, 2019). EAAT such as therapeutic horseback riding teaches children with special needs the rules of the sport, horsemanship techniques, and ways that they may control their bodies to ensure the human and horse interaction are meaningful (Kuropatkin, 2013). While working on the skills necessary for successful riding, participants are able to further enhance their attention, concentration, learning, and verbal skills (Kuropatkin, 2013). Our research will explore the observations of one instructor about the experiences and outcomes of EAAT with a youth with developmental disabilities.

752. **Humanizing the Past through Human-Canine Interactions in the Maine/Maritime Region: An Archaeological Case Study from the Holmes Point West Site in Machiasport, Maine**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Abby Mann, Graduate

Faculty Mentor:
Bonnie Newsom

Abstract:
The goal of this research is two-fold: First, archaeologists are challenged with humanizing their research, a task complicated by the often-arcane nature of our work. In an effort to humanize the archaeological record, this study explores human-canine interactions in the Maine/Maritime region through a multi-pronged and interdisciplinary case study. Second, indigenous communities and local stakeholders are frequently excluded from the research process, a result of long-standing exclusionary practices in academics and colonization of archaeology by western institutions. By examining the past through the lens of communities, this work offers a bridge between empirical and community-oriented archaeology.
Two dog burials at the Holmes Point West site in Machiasport, Maine are used to explore the unique and enduring social relationship between humans and their canine companions. Burial contexts are rich in evidence about the past and provide insight into cultural practices, dietary trends, and individual and community choices. Dietary evidence derived from archaeological bone collagen are used as an analogy for human diet, following the Canine Surrogacy Approach (CSA), also providing useful information about the lives of canine individuals at the site. Stable isotope analysis complements traditional lines of evidence, including faunal, ethnographic, and spatial.
Excavation and analyses of materials was completed in partnership with the Passamaquoddy Tribe, Maine Coast Heritage Trust, and the landowner. Ultimately, this project seeks to develop educational products for explicit use by community stakeholders invested in cultural heritage of the site, accomplished by combining empirical and community-oriented archaeologies to provide a more holistic interpretation of the past.

753. **Examining Social Work Students' Motivations in Choosing Clinical Concentrations**

Submission Type: Poster
Submission Category: Social Sciences and Humanities

Author(s):
Abigail Elwell, Graduate

Faculty Mentor:
Elizabeth DePoy

Abstract:
Many social work students are choosing clinical concentrations over macro or generalist practice. However, the reasons behind this decision are not always clear. A 1994 study explored factors which compel students to choose social work, including clinical concentrations, and found that life events such as alcoholism and trauma can motivate students to choose helping professions such as social work (Rompf & Royse, 1994). A more recent study from 2011 explored personal values and beliefs as they related to social work and therapy as a career choice; the author found that values of compassion and empathy affected students' choices to major in and build careers in social work (Osteen, 2011). However, currently there is a dearth of research exploring how students select clinical concentrations in particular. An in-depth study focusing on the perceptions of clinical work and how those perceptions relate to career choices is necessary.
To meet this need, a descriptive study will be used to answer the research question, "What are the factors that influence Master's of Social Work students at the University of Maine to choose clinical concentrations?" The sampling frame is comprised of the 25 students currently enrolled in the University of Maine's online-hybrid MSW cohort. The sample of convenience will be contacted by email via the mailing list available to students. The study is intended to examine in greater detail the perceptions of clinical social work and what motivates students to choose these concentrations, as well as what they hope to gain from the concentration and future career goals after graduation.

754. **The Practice of Documentary Poetics: Ethics, Poetics, and Cultural Memory**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Miranda Snyder, Undergraduate
Keaton Studebaker
Kristina King
Clinton Spaulding

Faculty Mentor:
Carla Billitteri

Abstract:
I will build upon Keaton Studebaker's work on the poetics of ZONG! to investigate the cultural work of documentary poetics. Specifically, I will examine how in Drift, Caroline Bergvall performs cultural translation and transnational and transhistorical framing of situations and

narratives. In Drift, Bergvall interrogates how the notion of passivity, as presented by Lisa Robertson, renders individual bodies, collective masses, and a collective sense of agency purposeless. In translating the experiences of Syrian refugees to the current reader and the cultural memory and connectivity that they are engaged in, Bergvall aligns the form and expression of these traumas with The Seafarer. As a result, conceptualization of the form and subsequent retelling of the refugees' traumas is influenced by the cultural associations imprinted onto our reading of the lines themselves. My examination of how issues of passivity, translation, collectivity, and cultural memory will bleed into issues concerning global humanitarian crisis's, borders, and nationality. Thus, my position as the concluding speak on the panel will contextualize the previous speakers' work in a current moment that prioritizes issues of agency and action. This relation will draw upon my analysis of the concept of destination in Drift. Bergvall exhaustively demonstrates that destinations only reflect the compulsion to control passive circumstances. The compulsion to document, translate, and interpret accounts deemed "foreign" springs out of this instance, as evident in the aim and form of Drift itself. Dr. Billitteri will chair and facilitate the panel.

755. **Exploring the Intersection of Climate Change and Cultural Heritage: The Case of Croatia's Eastern Adriatic Coast**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Lilja Bernheim, Undergraduate

Faculty Mentor:
Gregory Zaro

Abstract:
Over the Holocene, the dominant drivers of climate change have shifted from natural forcing to anthropogenic factors. In the twenty-first century, humans are increasingly witnessing and experiencing the ramifications of two-centuries' worth of pumping greenhouse gases into the atmosphere. The Mediterranean region in general and Croatia in particular has already started to and will continue to grapple with these human-induced climatic disturbances. Over the century, the Adriatic Coast of Croatia has and will see a notable increase in annual temperatures, decrease in annual precipitation, erratic and intense storms, and sea-level rise. Such climatic changes can have disastrous implications for cultural heritage. Humans have had a strong articulation with their environment for the past three to five thousand years. Cultural heritage sites, urban and landscape heritage alike, are the tangible evidence of the interplay between people and the

environment. In Croatia, major urban hubs along the Adriatic Coast showcase this mélange of living history. In the hinterlands between them and on coastal islands and waters, heritage abounds in the forms of viticulture, island agricultural landscape, and aquaculture. The examination of these heritage sites has vital implications for identity, tourism, and urban development – other factors compounded by climate change. Despite the current and potential degradation of heritage in the face of climate change, cultural heritage sites and the protection thereof in Croatia can offer a connection to climate change mitigation, adaptation, and resilience.

756. **Platonic Irony: How Custom Remains in Plato's Symposium**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Ivy Flessen, Undergraduate

Faculty Mentor:
Robert Ballingall

Abstract:
This article seeks to clarify a Socratic virtue far too often overlooked. Scholars memorialize Socrates as the man most liberated from custom or convention. They also rightly comment on how the Platonic Socrates covertly liberates his interlocutors from convention. That being said, few have recognized that through "The Symposium," Plato also offers readers the opportunity to learn that such liberation is much more difficult than one might think. I emphasize the resilient and ironic presence of custom in "The Symposium," a dialogue whose setting would lead one to expect an atmosphere of lawless debauchery. By focusing on how Socrates himself protects and upholds custom within this atmosphere, I show how Socrates secures for the philosopher a reputation for lawfulness. The brilliance of this strategy deserves recognition, not only because it enriches scholarly understanding, but also because its lessons remain pertinent in practice. It remains dangerous and perhaps impossible to erase custom from the political chalkboard. The philosopher who tries necessarily endangers both herself and philosophy. I therefore conclude by illuminating how "The Symposium" conveys a message of love from Plato to philosophers everywhere: know your limitations; you are too special to die at the hands of conventionalism.

757. **Walter Benjamin's Phenomenology in Baudelaire's Paris Spleen**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Noah Loveless, Undergraduate

Faculty Mentor:
Steve Evans

Abstract:
My project concerns the philosophy and literary criticism of the 20th century thinker, Walter Benjamin. Walter Benjamin was a Jewish and German thinker who wrote on academic topics like philosophy and 18th century German literature as well as more prescient topics like how one is to personally understand modern experience. In the late 1930s, amid the rise of Nazism, Benjamin chose to focus most of his research and criticism on the history of the city of Paris in the 19th century as a prime example of how this new urban society was one that was radically new and philosophically rich. Benjamin's research on Paris was left unfinished but has since been collected and organized, following his framework, under the title The Arcades Project. Amid Paris in the 19th century, Benjamin found one particular figure, a poet to stand out as a prime resource for understanding the rapid development, Charles Baudelaire. Benjamin, in attempting to chart the rapidly developing urban space, looked to the French poet and essayist Charles Baudelaire as a beacon of writers who are able to adequately capture the urban experience. Thus Benjamin dedicates the largest chapter of The Arcades Project to Baudelaire. My research has focused on Benjamin's philosophy in several of his later texts on Baudelaire, as well as Charles Baudelaire's final unfinished book of poems Paris Spleen. My project focuses on reading several of the poems from this book in the light of Benjamin's focus on Baudelaire, and attempt to provide a picture of the multifaceted life of the modern urban experience. I am attempting to understand how Baudelaire's scenes in Paris Spleen reflect one's radically new, shocking, and alien experience of urbanity through the lens of Benjamin's research and aims.

758. **The Nelson Family: The Lives, Times, Hardships and History of a Maine Swedish Immigrant Family**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Lukas Lagasse, Undergraduate

Faculty Mentor:
Susan Pinette

Abstract:
"The Nelson Family: The Lives, Times, Hardships, and History of a Maine Swedish Immigrant Family" focuses on a family of Swedish-born immigrants who left their home country in 1871 after relentless religious persecution and unprecedented crop failures, and sought refuge within the forests of Maine. This work begins with the family's early life in Sweden, relying on church records and law records pertaining to the incarceration of father Hans Nilson who became a member of the Baptist church in a strictly Lutheran country. The family's journey is then traced using ship manifests documents, autobiographical resources, and various emigration records as they travel over the Atlantic Ocean until they find a new home within the borders of a small colony named "New Sweden, Maine" The research follows the lives of each of the 12 family members. Some leave to work out of state, some remain in New Sweden to farm and even follows the life of a sister who attended college in distant Michigan.Tracking these individuals is done so through family documents, (including private letters translated from Swedish to English) obituaries, newspaper articles, censuses, and other genealogical resources. Rare books pertaining to the settlement of New Sweden have also been included.

This work also focuses on the circumstances that led the state of Maine to allow this mass immigration into its borders. When William Widgery Thomas Jr. of Portland, ME was elected war consul to Sweden under Abraham Lincoln and eventually Commissioner of Immigration to his home state. Many of Thomas' documents are held by New Sweden Historical Society along with his reports of immigration. This documentation represents best the true situation and clearly states the uncensored truth about the hardships this family and others faced.

Professional genealogists have verified the documentation and resources: Gunnar Wennerström, who runs the Swedish Emmigrant Institute in Växjö, has been of significant help tracking down records pertaining to the family while they were located in that country and Lynn Johnson, who has made it her mission to document these Swedish Americans who can trace their roots back to New Sweden, Maine. Her database includes nearly 25,000 identities, each one carefully researched before being added to her work.

This work is the compilation of many years of research and has been tediously selected and executed in order to not only address how the Nelson Family persevered, but, examine their lasting impacts in Maine, New England and the Country as well as those other Swedes who made their home in Maine's Swedish Colony.

759. **Community Forum for Parents**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Ming-Tso Chien, Graduate
Hadley Porreca
Kittiya Reeves
Sara Hunt
Emma Richardson

Faculty Mentor:
Daniel Puhlman

Abstract:
The purpose of this presentation is to introduce a community outreach initiative from the Parenting Relationships Research Lab at the College of Education and Human Development. The first overarching goal of the initiative, titled Community Forum for Parents, is to provide a space where parents in the neighboring communities around the University of Maine to come together to network and share their perspectives and experiences about a variety of topics about parenting. For the Spring Semester of 2020, the lab designed two forums, one for international parents and the other for student parents. In this presentation, members from the lab will share about the following aspects of the community forum: the conceptualization of the forum, the design of the recruitment materials, the participant recruitment process, the design of informational materials, the forum facilitation, as well as the forum experience evaluation. Another goal of the initiative is for the lab to explore new directions for parenting research. This presentation will illustrate how community outreach and research can be mutually informative. This is a significant demonstration of how academia can engage the community.

760. **Do Men and Women Differ in Risk Profiles for Mild Cognitive Impairment?**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Amy Halpin, Graduate

Faculty Mentor:
Rebecca MacAulay

Abstract:
Objective: Low levels of cerebrospinal fluid (CSF) amyloid beta, and high levels of phosphorylated tau and total tau, are critical biomarkers of Alzheimer's disease (AD). CSF changes can occur several years before cognitive decline, making them a valuable tool for prediction of mild cognitive impairment (MCI) and AD; however, research suggests predictive validity may differ by sex. We investigated biomarkers relationship with memory function in MCI and whether these associations differed by sex. Methods: 630 older adults (59% men, Mage=72.37) from the Alzheimer's Disease Neuroimaging Initiative database were included. CSF biomarkers and baseline cognitive testing were obtained within six months of each other. Rey Auditory Verbal Learning Task immediate recall, learning and forgetting scores measured episodic memory. Results: Women were younger and generally had better memory performance. Non-parametric tests revealed women had significantly more pathological levels of t-tau than men. Women demonstrated more significant correlations between the CSF biomarkers and episodic memory than men. Fisher r-to-z transformations revealed significant sex differences in the magnitude of these relationships. Conclusions: Findings suggested differential validity in CSF biomarkers ability to predict episodic memory performance in men relative to women. This paper presentation will discuss findings in terms of clinical implications and future directions for improving understanding of AD.

761. **Does Sleep Contribute to Dual-Task Gait Disturbances Beyond Executive Attention in Older Adults?**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Angelica Boeve, Graduate
Amy Halpin
Lisa Derrico
Michael Fagan
Sahvannah Michaud
Rebecca MacAulay

Faculty Mentor:
Rebecca MacAulay

Abstract:
Sleep issues increase with age and are associated with worse executive function and attention. Research also suggests that sleep problems may contribute to gait dysfunction. Whether sleep influences gait characteristics beyond the established relationship between executive attention and gait remains unclear. We aimed to determine whether sleep problems contributed to gait characteristics beyond executive attention during a cognitive dual-task (DT) walking condition. Fifty-five community-dwelling older adults (M = 72, SD = 6) underwent neuropsychological testing and clinical interview during the Maine Aging Behavior & Learning Enrichment Study. The GAITRite® system objectively measured gait characteristics during simple and DT walking conditions. Sleep estimates were derived from the Pittsburgh Sleep Quality Index. The Trails Making Test evaluated Executive Attention. Hierarchical multiple regressions revealed that Executive Attention contributed to 9-20% of the variance in DT velocity, step time, and stride length. Sleep estimates did not predict DT gait beyond the influence of executive attention. However, specific relationships between sleep quality and somnolence on DT gait asymmetry were found. This presentation will discuss these findings in the context of future mechanistic research that may help to better understand these relationships and improve diagnostic accuracy and treatment for cognitive and functional decline.

762. **Documentary Practices and Documentary Discourse in Contemporary Anglophone Literature: Affect and the Limits of the Sayable in M. Nourbese Philip's Zong!**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Keaton Studebaker, Graduate
Kristina King
Clinton Spaulding
Miranda Snyder

Faculty Mentor:
Carla Billitteri

Abstract:
My presentation focuses on the intersection of history, documentary practices, and affect in M. Nourbese Philip's 2008 book of poetry, Zong!. In 1781, the captain of the slave ship Zong fraudulently sank his ship and murdered 150 African slaves hoping to collect insurance money. The poems Philip crafts in her book use only the words of the legal proceeding that immediately followed: Gregson v. Gilbert, the only remaining historical document from the Zong massacre.

My presentation considers the relationship between the form of Philip's poems and the affective dimension of her text. Philip fragments the language of the court document and opens a space of "felt" and unspoken utterance—the utterance of what cannot be said. The space that Philip opens makes it possible for the Zong massacre to be remembered without being trivialized or explained away. Through an analysis of poetic fragmentation, my presentation elaborates on the turn from meaning to sense in Philip's writing. Calling attention to the ways in which her poems implicate readers in a textual and affectual experience, I find that—in stark contrasts to the univocality of Gregson v. Gilbert—Philip's poetry evokes the sense of a choral voice that communicates across time.
This presentation is part of a panel collaboration with Kristina King, Miranda Snyder and Clinton Spaulding. Dr. Carla Billitteri has agreed to be the panel chair and facilitator.

763. **Documentary Practices and Documentary Discourse in Contemporary Anglophone Literature: Pedagogical Potential**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Clinton Spaulding, Graduate
Kristina King
Keaton Studebaker
Miranda Snyder

Faculty Mentor:
Carla Billitteri

Abstract:
Informed by the field of media ecology, a metadiscipline that seeks integrated and holistic accounts of the consequences fashioned by the collision of technology, culture, and consciousness, my presentation will highlight the findings of an exploration of documentary poetic projects including Charles Reznikoff's Testimony, works from Mark Nowak, and Kaia Sand's Remember to Wave. My presentation focuses on the pedagogical potential in documentary poetics. Spanning the better part of a century, from the 1930s to the present, American documentary projects have been composed and presented in a number of media. Within each medium the potential for pedagogical exploration and reflection is present and varied. Using Reznikoff's work with historical documents as a foundation, this presentation will share how Mark Nowak's work has established communication between auto workers on two continents while also fostering a new sense of agency among unionized workers through

America's rust belt and juxtapose this work with Kaia Sand's participatory, cultural map making in Portland, Oregon.
This presentation is a part of a panel collaboration with Kristina King, Keaton Studebaker, and Miranda Snyder. Dr. Carla Billitteri has agreed to be the panel chair and facilitator.

Bionote
Clinton Spaulding is a PhD candidate in Communication. He is a graduate teaching assistant and undergraduate advisor for the CMJ Department at the University of Maine. Over the past three years, he has taught Modes of Media Criticism, Public Relations, and Public Communication. Clinton recently presented at the 51st NeMLA conference on Charles Reznikoff's work, Testimony, and its impact on 21st century documentary poetic work; specifically, the work of Kaia Sand's Remember to Wave. His research interests include poetics, media ecology, critical pedagogy, and the methodology of critical geography.

764. **Documentary Practices and Documentary Discourses in Contemporary Anglophone Literature: Narrative and Collective Subjectivity in Documentary Poetics**

Submission Type: Oral Presentation
Submission Category: Social Sciences and Humanities

Author(s):
Kristina King, Graduate
Keaton Studebaker
Clinton Spaulding
Miranda Snyder

Faculty Mentor:
Carla Billitteri

Abstract:
Is docupoetry an answer to the epistemological and existential problem of the relationship between narrative and "truth"? A prevalent scholarly interest in acts of "framing" serves here as an orientation toward an inherent multiplicity of perspectives on any intersubjective experience, particularly on narratives of history. This presentation rejects dualistic conceptions of the functions of documentary and poetry, in favor of the broader range of perceptions enabled by documentary poetics. The Blunt Research Group's proposition that speech could "become a way of listening" frames this discussion of potential benefit and harm of application of genre categories and traditional critical orientations to documentary poetics projects. Drawing from an emerging critical tradition of theorizing docupoetry, I describe the features of multiple

documentary poetics projects as being illustrative of collective subjectivity. The idea of co-authorship of self is an opportunity to consider docupoetry projects as assertions of collective experience and presence — where “history” fails to affirm one’s lived experience, presentations of a collective self may provide an alternative avenue for a kind of self-determination. I argue that such narrativized representations of collective experience are more ethical representations of history than those enacting traditional conceptions of documentary. This presentation is a part of a panel collaboration with Miranda Snyder, Clinton Spaulding, and Keaton Studebaker. Dr. Carla Billitteri has agreed to be the panel chair and facilitator.

Natural Sciences

Projects 801 - 858

Natural Sciences

801. **Distribution of First Row Transition Elements in Eclogites**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Natalie Harmon, Undergraduate
Alicia Cruz-Uribe
Jesse Walters

Faculty Mentor:
Alicia Cruz-Uribe

Abstract:
Surficial materials are recycled back into the deep Earth at subduction zones. The oxidation state of subducted materials affects the oxidation state of major geochemical reservoirs in the Earth, such as the mantle and the crust. First row transition elements (FRTEs), such as V and Sc, are highly redox sensitive and thus have the potential to track important redox processes in subduction zones. In this project, concentrations of FRTEs in garnet, omphacite, and rutile were determined for a global suite of oceanic eclogites, which represent exhumed subducted materials. Data were collected by LA-ICP-MS using an ESI NWR193UC laser ablation system coupled to an Agilent 8900 ICP-MS/MS. Ablation conditions were 12–20 µm spot size at a fluence of ~3 J/cm2 and a repetition rate of 5–8 Hz. Trace element concentrations in garnet and omphacite were determined relative to NIST SRM612, and relative to R10 for rutile. NIST SRM610, GSD-1G, GSE-1G, and R19 were analyzed as quality control materials. Elements such as V and Cr are preferentially partitioned into rutile over the silicates, whereas Sc, Co, Zn, and Ge are predominantly found in omphacite and garnet. Scandium, Co, and Ga were below detection limit in rutile, and Ni and Ge were only measurable in omphacite and garnet, respectively. Scandium is more compatible in garnet than omphacite. Zinc and Ga are more compatible in omphacite than garnet. Omphacite/garnet partition coefficients for Co are close to 1.

802. **In Planta Examination of CRISPR-Cas9 Editing on Minichromosomes**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Benjamin Moore, Undergraduate

Faculty Mentor:
Ek Han Tan

Abstract:
Synthetic biology is a burgeoning field that is currently underexplored. Naturally occurring minichromosomes are suitable targets to examine synthetic biology techniques. In Arabidopsis thaliana, minichromosomes are genetic artifacts left behind after centromere mediated genome elimination, a haploid induction system that has been characterized in this species. Our goal is to show that minichromosomes can be edited, modified, or transferred with no unfavorable consequences to the organism that hosts it. CRISPR-Cas9 (CRISPR) is a tool used for precise genome editing in plants and animals. We are investigating to see if CRISPR-Cas9 can be used to modify an Arabidopsis minichromosome, Mini1a. First, to study Mini1a stability, this line was propagated to the F10 generation. Second, we transformed paired single guide RNAs (sgRNAs) with the nickase version of Cas9 to test if the minichromosomes can be modified. We will perform DNA sequencing across the CRISPR sgRNA sites to determine if there were any changes made. Third, to test if Mini1a can be transferred via haploid induction, GFP-tailswap inducer lines that contain Mini1a were isolated and crossed with Ler gl1 line. We hope to show that that precise in planta manipulation of minichromosomes is feasible via CRISPR-Cas9 and that minichromosomes are viable platforms for chromosome engineering in plants.

803. **Tapping the Sweet Spot: Predicting the Suitability of a Woodlot's Potential to Transition into a Productive Sugarbush in Maine**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Deven Teisl, Undergraduate

Faculty Mentor:
Jessica Leahy

Abstract:
Before America was colonized, the Penobscot and other Wabanaki tribes in Maine were boiling the sweet sap produced by Acer saccharum, or sugar maple, into maple syrup. This tradition continues to this day, and while the State currently ranks third in overall production of maple

syrup in the United States, there has been growing interest within the maple syrup community to focus on expansion. Some producers want to expand their current operations and others wish to make the industry easier for new producers to enter. My research aims to not only identify the key site characteristics that must be present on a woodlot for it to transition into a productive sugarbush, but also create a site assessment tool that can be used by new or current producers to compare woodlots. Through a meta-analysis of current research and data collection on seven woodlots, both active and non-sugarbushes, I have identified a list of eight key site characteristics that must be present on a woodlot to ensure its transition into a productive sugarbush. An anonymous survey was completed (n=31) by members of the Maine Maple Producers Association, in which they ranked each of the eight characteristics importance and contribution to overall sugarbush production. This research is unique in that it incorporates the experiences and knowledge of those currently in the maple syrup industry into the site assessment tool. Also, this research has produced a site-assessment tool that will allow the maple industry to grow, furthering increasing its cultural and economic importance to the State of Maine. Results from the survey indicate that each of the eight site characteristics are important to overall site productivity. The weighted survey results have been developed into a site assessment equation that will allow a producer to compare and contrast the productivity of multiple woodlots, making it easier to either expand their current operation or allow a new producer to get started on their sugaring operation.

804. **Investigating the Environmental Impacts of Abscisic Acid Levels in Soybean Drought Response**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Abigayl Novak, Undergraduate
Yu-Ying Chen
Dr. Yongjiang Zhang
Dr. Scott McAdam

Faculty Mentor:
Yongjiang Zhang

Abstract:
Since the frequency and severity of droughts are predicted to increase in many regions of the world, understanding plant drought response is important for securing food production. Although the well-known plant hormone Abscisic Acid (ABA) is related to plant drought response, the

detail mechanism remains poorly understood. In this research, the physiological role of ABA in plant drought response has been studied. Two varieties of soybeans were tested, PI 41693 (drought resistant) and Hutchenson (drought intolerant). The main goal focused on how ABA interacts with stomatal regulation, transpiration, photosynthesis and turgor loss under drought and during recovery. By using the method known as LCMS, the levels of ABA were measured and analyzed for the way they use ABA. Differences in PI and Hutchenson varieties indicate there are significant values in photosynthetic rate, stomatal conductance, and slight significance in midday water potential. PI invests more energy into stem width and less investment in height of the plant when compared to HU. The involvement of ABA in the drought response between the two varieties will be discussed. This research will advance our fundamental understanding of plant drought response and provide a new perspective on breeding of drought-resistant crop varieties and plants in their natural environments.

805. **Cysteine-Based Glycan Auxiliary to Facilitate Glycomics and Glycoscience Investigations**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Emma Lueders, Undergraduate
Matthew Brichacek

Faculty Mentor:
Matthew Brichacek

Abstract:
Glycans are involved in many key functions and biological pathways such as cellular structure, DNA repair, and intercellular signaling. Currently, the isolation of glycans from natural sources is challenging and a need for improved methods is evident. This study explored the synthesis of L-cysteine methyl ester, and its functions as a chemical auxiliary, to aid in the isolation of glycans. Reductive amination was utilized to conjugate lactose, a simple glycan, to the chemical auxiliary to establish a general protocol. The synthesis of the L-cysteine methyl ester auxiliary was accomplished with only modest success due to unforeseen difficulties with reaction monitoring, purification, and thiol reactivity. Through extensive optimization, L-cystine dimethyl ester was selected as a superior auxiliary to mitigate thiol reactivity. Further investigations with this novel glycan auxiliary will facilitate glycan isolation methods and aid research in glycoscience.

806. **Temperature Variability in the Kuroshio/Oyashio Current Region of the Northwest Pacific Ocean**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Mitchel Stewart, Undergraduate

Faculty Mentor:
Andrew Thomas

Abstract:
An analysis of the northwest Pacific, January 1982 to December 2019, was conducted using Optimally Interpolated Sea Surface Temperature (OISST) data. The data are from NOAA Earth Sciences Research Lab (ESRL), Boulder CO at ¼ degree spatial resolution and are monthly averaged fields. Are there any significant temperature trends in the region? If so, where, and do external climate processes play a role? A 30 year (1982-2011) climatology was calculated, subtracted from the monthly data to form monthly SST anomalies, then both overall anomaly trends and a monthly breakdown of trends calculated at each grid point. SST anomalies were regressed against 3 indices of basin-scale Pacific climate variability, El Nino Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and the North Pacific Gyre Oscillation (NPGO). Overall trends show most warming 30°N, east of Japan. The Kuroshio Extension is warming faster than the southern portion of the western Pacific, ~0.5°C per decade. On a monthly basis, warming is greatest in summer (August/September). North of the Kuroshio Extension, an area of cooling (~0.25°C per decade) exists in winter-spring (January-April). The ENSO index has a weak impact on the Kuroshio extension, but may have some effect off southern Japan. The PDO relationship is inverse to SST anomaly trend, and NPGO has a positive impact on the region. The strength of the regressions show in the Kuroshio Extension, the PDO appears to be the strongest driver of SST anomalies.

807. **Recent Temperature History of the Juneau Icefield**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Jacquelyn Bellefontaine, Undergraduate
Bradley Markle

Paola Araya
Abigail Lambert
Andreas Gschwentner
Ona Underwood

Faculty Mentor:
Seth Campbell

Abstract:
Alaskan glaciers are melting at an unprecedented rate and are contributing significantly to global sea-level rise. The Juneau Icefield (JIF) of southeast Alaska is one of the world's largest, longest-studied icefields and is currently in a documented state of thinning and retreat. Understanding the climatological context of the JIF is critical to determining the sources of observed changes, as well as the future of the region. Additionally, understanding the driving mechanisms of change in the JIF could help explain changes observed in similar alpine glacier systems.
Here we investigate the recent temperature history of the Juneau Icefield, using a combination of reanalysis data and in situ temperature observations from the Juneau Icefield Research Program (UMaine). Overall, we find an increasing annual average temperature trend of approximately 0.19°C per decade since the 1950's. Interestingly, this warming is entirely a winter-season signal. We find no significant trend in summer-season temperatures, but an upward winter-time trend of nearly 0.5°C per decade, over twice that of the annual average. This pattern is consistent between the reanalysis products and the local temperature observations across the JIF. Using measurements from meteorological stations across the icefield, we find that the magnitude of winter-season warming (and that of the annual mean warming) depends strongly on surface elevation: the higher the surface elevation the larger the trend in warming. These results have implications for the cause of recent glacier changes across the icefield and could impact the future stability of the JIF.

808. **A comparative and genomic analysis of mammalian bladder-related phenotypes**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Jessica Beneski, Undergraduate
Diane Genereux
Danielle Levesque

Faculty Mentor:
Danielle Levesque

Abstract:
For my project, I have developed a phenotypic database of physiological and behavioral bladder functions related to urine use across mammalian taxa. To develop the database, I have conducted extensive literature review of the known functions of the bladder and urine in different mammal species, and defined distinct categories for those functions. I am compiling a list of the mammal species in each category and annotating a mammalian phylogenetic tree to illustrate which mammals have which bladder-related functions. This will allow me to identify whether a particular bladder function or urine use evolved once or multiple times across lineages. Looking forward, the phenotypic database I develop will be used in conjunction with publicly available genome-sequence data for mammals to identify which genes are involved in which bladder functions and how the different mammalian groups vary genetically according to their bladder-related functions.

809. **The Role of Prophage in Mycobacterial Antibiotic Resistance**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Jacob Cote, Undergraduate

Faculty Mentor:
Sally Molloy

Abstract:
Bacteria in the genus Mycobacterium cause medically significant diseases such as tuberculosis (M. tuberculosis), with an estimated 2 billion people infected worldwide (1). Opportunistic mycobacteria such as M. abcsessus, M. chelonae and M. fortitum are an increasing public health concern due to extreme antibiotic resistance and a lack of effective treatment options (2). Understanding antibiotic resistance mechanisms in mycobacteria is key for the development of new, more effective treatments. whiB7 is a conserved transcriptional regulator in mycobacteria that activates expression of genes known to contribute to antibiotic resistance (3). The Molloy lab has demonstrated that the presence of prophage (bacteriophage genomes integrated into bacterial genomes) increases expression of the whiB7 regulon and increases antibiotic resistance in pathogenic mycobacteria (4). In order to show that the observed antibiotic resistance in M. chelonae carrying prophage is due to the upregulation of the whiB7 regulon, we aim to measure

antibiotic resistance in strains in which whiB7 expression is blocked. The goal of this project is to knock down the whiB7 gene in pathogenic M. chelonae, both with and without prophage, using a CRISPRi approach. (5) We have designed and created guide RNAs expressed from CRISPRi plasmid pLJR965 that will target whiB7 gene sequences. We are testing these constructs in M. chelonae carrying prophage and control strains to determine if whiB7 expression is decreased and the antibiotic resistant phenotype is lost.

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810. **Climate-Driven Range Shifts by Maine Peromyscus Species**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Molly Bennett, Undergraduate

Faculty Mentor:
Danielle Levesque

Abstract:
With changing climates, two species of mice in Maine (Peromyscus maniculatus and Peromyscus leucopus) are currently undergoing range shifts. The objective of my project is to determine the historical and current range of each species within the state of Maine. I used two approaches: identify to species samples obtained from the Acadia and Orono areas and a literature review of previous research and trapping within the state. I used ear biopsies collected this summer in Acadia National Park and throughout the state by the Gardner and Levesque labs to genotype the mice as either P. maniculatus or P. leucopus. Additionally, I summarized research that denotes where the two species were historically present around the state. These

species are functionally impossible to tell apart in the field, and projects that use small mammal trapping often simply choose one of the two species to identify all uncertain mice. However, understanding the ranges of the two species could yield information as to how the two species might differ as reservoirs for tick-borne disease, catalysts for forest community development, and models for mammalian range shift.

811. **The Impact of Well-Water Contaminants on the Behavior of Danio rerio Embryos**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Abigail Muscat, Undergraduate
Remy Babich
Nishad Jayasundara

Faculty Mentor:
Nishad Jayasundara

Abstract:
Contaminated drinking water is a global health concern. In the state of Maine, arsenic contamination is of particular concern as it is a naturally occurring element found in one in ten wells. Studies have shown that long-term exposure to arsenic can exacerbate bladder cancer symptoms, impact neurological functions, and affect child IQ levels. Despite this evidence, it is difficult to conclusively determine the effects caused by exposure to a given water source, given the potential interactive effects with other chemical compounds including metals. Furthermore, long-term exposure impacts are difficult to determine based on chemical composition analyses. Our objective is to gain an understanding of the combined impact of heavy metal well-water contaminants on behavior of zebrafish Danio rerio. Zebrafish are a common biomedical model and we focus on their behavior, since metals (e.g., Cd, As, Pb) are known to alter swimming patterns. Our team collected well-water samples from Mount Desert Island and exposed D.rerio embryos to well-water samples 24 hours post fertilization (hpf). Ongoing studies include conducting a behavioral assay 5 days post fertilization to determine neurological impacts of drinking water contaminants. Additional metrics are an energetic assay (test susceptibility to chronic disease) and a life-span assay. Preliminary findings have shown that contaminants, such as arsenic, vanadium, and lead impact respiratory function and embryonic development in D.rerio. Future research includes developing a model based on these assays that can be used to gauge the quality of a water sample.

812. **Examining Changes in Ocean Climate of the Northeast Pacific**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Jonathan Maurer, Undergraduate
Andrew Thomas

Faculty Mentor:
Andrew Thomas

Abstract:
The Northeast Pacific Ocean is highly dynamic on interannual and decadal time scales due to both local and nonlocal forcing mechanisms. In order to separate the effects of these phenomena, this study correlates time series of 3 major Pacific climate indices and wind forcing with anomalies of 2 oceanographic variables, sea surface temperature and sea surface salinity. The study area is the ocean between Baja California and the south coast of Alaska, and the study period is from January 1982 to December 2018. Climate indices used in this study were El Nino Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and the North Pacific Gyre Oscillation (NPGO). Sea surface temperature data used for this study is derived from NOAA's monthly optimally interpolated sea surface temperature data set (OISST) at a quarter degree resolution, while wind speed and SSS are monthly data derived from Remote Sensing Systems SODA model at one-degree resolution. To remove the seasonal cycle, anomalies were calculated for all three variables based upon a climatology from January 1982-December 2011. At zero lag, sea surface temperature displays the highest positive correlation to ENSO off the coast of Baja with decreasing correlations moving north and west, while PDO displays strong correlations in all areas along the coast and equator, and NPGO has strong correlations in the region enclosed by the coast and equator. At zero lag, sea surface salinity displays less robust trends and correlations for all local and nonlocal forcing.

813. **Jambalaya: Two Integrases are Better Than One**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Margaret Perrotta, Undergraduate
Evan Warburton

Claire Bourett
Sophia Suriano

Faculty Mentor:
Melody Neely

Abstract:
Bacteriophage, viruses that infect bacteria, are the most abundant and diverse of all biological entities at an estimated 1031 particles on Earth. Studying bacteriophage (phage) presents a unique chance to explore the genetic code integral to biology in a concise and efficient manner. Jambalaya is a novel Gordonia terrae phage isolated from a farm in Orono, Maine. Characterization of Jambalaya included imaging, sequencing , and annotation using SEA PHAGES and bioinformatic tools, to create a comprehensive understanding of its genome and life cycle. Sequencing revealed a genome that is 57,764 base pairs long, with 89 potential genes, and a high 67.8% GC content consistent with G. terrae. It belongs to the DC1 subcluster with high synteny and identity with its cluster mates including TillyBobJoe, Valary, and Orono phage RogerDodger. Similar to other DC1 phage, Jambalaya's genome encodes for two integrases, a tyrosine, and a serine integrase. Additionally, the integrase region is poorly conserved between DC1 phage. When combined with poor ability to form lysogens, visually clear plaques, and a temperate cluster, these results create an incomplete picture of Jambalaya's lifestyle. Further research of Jambalaya could include investigating regulatory sequences and more diverse host and lysogeny assays to determine what other bacteria it can infect as well as its life cycle and other unexplored functions.

814. **Resistance of Phytophthora erythroseptica to oxathiapiprolin and its potential risk**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Alice Chesley, Undergraduate

Faculty Mentor:
Jianjun Hao

Abstract:
Phytophthora erythroseptica causes pink rot of potato and has resulted in significant yield losses to potato production in the north region of the US, including Maine. The newly developed

fungicide oxathiapiprolin is effective to control pink rot. However, P. erythroseptica could evolve to overcome the fungicide and become a resistant population, resulting in the loss of efficacy of the fungicide. To evaluate the risk of resistance development in P. erythroseptica, effective concentration for 50% mycelial growth inhibition (EC50) was established with 35 P. erythroseptica isolates. Results showed that EC50 ranged from 0.00063 ug/mL to 0.0033 ug/mL, with median value of 0.0015 ug/mL. The EC50s showed a normal distribution, indicating no mutant population was found from the isolates collected. Agar plugs of P. erythroseptica were incubated on an agar plate amended with oxathiapiprolin at the minimum inhibitory concentration (MIC). One mutant was obtained an EC50, which was 322 times higher than the parental wild type strain. Tests are ongoing to determine the fitness of this mutant. Given the results, potato growers will have new information for combating P. erythroseptica using oxathiapiprolin, in addition to furthering the scientific community's knowledge about the invasive oomycete and risk of mutation development.

Acknowledgements
This project was made possible through UMaine's Plant Pathology lab, UMaine' Work Study program, and funding from USDA-NIFA Special Research Grants Potato Breeding and Maine Potato Board.

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Lu, X H, et al. 2011. Wild type sensitivity and mutation analysis for resistance risk to fluopicolide in Phytophthora capsici. Plant Disease, 95: 1535-1541.
Miao, et al. 2016. Resistance assessment for oxathiapiprolin in Phytophthora capsici and the detection of a point mutation (G769W) in PcORP1 that confers resistance. Frontiers, 7:615.

815. **Hydrographic Variability in the Gulf of Maine**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Emma Dullaert, Undergraduate

Faculty Mentor:
Andrew Thomas

Abstract:
This study characterizes the spatial and temporal variation of select physical ocean properties of the Gulf of Maine. Time series of hourly temperature, salinity, and density data at various depths

were extracted from 3 NERACOOS buoys in the Gulf of Maine, spanning a time frame of 19 years from 2001 to 2019. The hourly data were quality controlled and then averaged into daily and monthly means. A monthly climatology was formed and then monthly anomalies calculated for each time series. These data were used 1) to investigate overall trends of warming and/or cooling, 2) to quantify the relationship between temperature variability and trends at the sea surface with those occurring at depth, and 3) to quantify any trends in the timing (beginning, duration, end) of seasonal stratification, a key environmental metric of biological importance. Spatially, a comparison of these parameters was made between two buoys located in shallower water near the coast and one offshore buoy located in deeper water. The data show strong seasonal cycles in both temperature and density, with strong stratification in the summer months and a well mixed water column in the winter for depths between 1 and 100m. All three buoys show warming trends at all depths over the study period. Depths below 100m at the offshore buoy have much weaker seasonal cycles and are generally density-separated from the upper layer all year round.

816. **Education and Charitable Giving**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Tanner Towle, Undergraduate

Faculty Mentor:
Philip Trostel

Abstract:
There has been substantial research on the factors that influence charitable giving. One of the factors most strongly associated with charitable giving is education. Most studies find education to be positively related with charitable giving. However, despite the significance of education with respect to charitable giving, education is rarely the central focus of studies on charitable giving. In addition, the unique characteristics of data on charitable giving (i.e. high volume of zero-observations) present methodological challenges that require careful analysis. Here we focus on the relationship between education and charitable giving using over twenty years of consumer expenditure data as well as several different methods of econometric analysis. In doing so, we find that education is positively related with charitable giving, and that failing to account for the unique characteristics of data on charitable giving may produce an inaccurate or incomplete picture of the relationship. These results confirm the findings of previous studies on

charitable giving and contribute to our knowledge of the wider public benefits accrued from education.

817. **Investigating Approaches to Monitor the Rare Bicknell's Thrush**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Michael Turso, Undergraduate
Kaitlyn Wilson

Faculty Mentor:
Amber Roth

Abstract:
Bicknell’s thrush (Catharus bicknelli) is one of the highest conservation priority species internationally. Effective monitoring methods are critical to understanding population changes. Tracking birds with telemetry is expensive, resource intensive, and difficult to apply on large scales. Acoustic recording units (ARUs) allow for more passive and less resource-intensive data collection that may be more accurate and cost-effective. My research objectives were (1) to investigate if Bicknell’s thrush is comparably detectable using ARUs relative to GPS telemetry and (2) the point-count survey method, and (3) to assess the occupancy of Bicknell’s thrush in the interest of informing land management decisions. ARUs were deployed on Mount Redington in western Maine, and I conducted point-count surveys at these same locations. Four birds were captured and equipped with GPS tags to generate home range estimates. I extracted vocalizations from the sound recordings and compared detections with the telemetry and point-count data using contingency chi squares to assess the relative efficacy of the three monitoring methods. I used hotspot analysis to relate thrush presence-absence from the ARUs to a gradient of relative use based on telemetry data. Results suggest that acoustic monitoring, and possibly point-count surveys, can be both comparably effective and less resource and labor-intensive alternatives to GPS telemetry but only in areas of high relative use by thrushes. ARUs were less effective at detecting thrushes in areas of low use. ARUs are becoming widely used for this species; thus a better understanding of thrush detectability and likelihood of false negatives is important to interpretation of results.

818. **Climate Change and Nest Parasitism of Rusty Blackbirds (Euphagus carolinus) by Bird Blow Flies (Protocalliphora)**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Emily Tomak, Undergraduate
Luke Douglas

Faculty Mentor:
Amber Roth

Abstract:
Rusty Blackbird (Euphagus carolinus) is a spruce-fir forest obligate bird that is in sharp decline. As their range retracts due to climate change and other anthropogenic factors, the additional stress puts this species especially at risk to parasites such as Protocalliphora, a genus of blow fly that parasitizes nestlings. This project analyzes the relationship between ambient temperature patterns at Rusty blackbird nests during egg laying, incubation, and the maturation periods of nestlings with the presence of Protocalliphora in nests between two study areas located in Coos County, New Hampshire and Franklin County, Maine in 2019. iButton temperature monitors were placed near and in nests to track the ambient temperature fluctuations of the nests. A variety of blood sampling techniques were used to assess the bird's physical condition. After the young fledged, all nests were collected and sent to a lab for analysis to identify the species and quantity of Protocalliphora larvae present. A total of 33 nests were located across the study sites, however only 6 of these nests presented with a species of Protocalliphora. Out of these 6 nests with Protocalliphora found, 4 were located in Maine and also contained the majority of the parasite count. This will provide important insight on nesting ecology and stresses on Rusty Blackbird populations, which are already vulnerable and decreasing.

819. **Effects of Repeated Intensive Harvesting Practices, Prescribed Burning, and Browsing on Northern Mixedwood Forest Plant Communities**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Michaela Kuhn, Undergraduate
Bethany Muñoz Delgado\

Faculty Mentor:
Amber Roth

Abstract:
Woody biomass, often extracted by intensive harvesting practices, is commonly used as a renewable resource as an alternative to fossil fuel that can help mitigate the effects of climate change. Long-term effects of woody biomass harvesting practices, coupled with mammalian browsing on woody and nonwoody plants following treatment, are not well understood in northern mixedwood stands. Use of prescribed burning, a practice that also reduces on-site woody biomass, will become more evident in the State of Maine as land managers consider adapting management to climate change. In 1964-65, strip-cutting was applied in 3 treatments: 1) woody slash left, 2) woody slash left and burned, and 3) woody slash removed on the Penobscot Experimental Forest. In 2018, this study area was harvested again posing a unique opportunity to investigate long-term changes in understory plant communities and tree regeneration 55 years following initial application of these treatments. In 2019, this experiment was revisited to assess vegetation regenerative success after repeated intensive land practices. Results of this study encompass the cumulative effect of the treatments on plant diversity, floristic quality, and browse damage extent.

820. **Feedbacks between wood structure and function drive forest tree responses to extreme drought**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Madeline Eberly, Undergraduate
Ruth Van Kampen
Kelly French

Faculty Mentor:
Jay Wason

Abstract:
Climate change is expected to cause more frequent and severe drought in Maine. Measuring how trees store and access water during drought and how that relates to wood anatomy can improve our understanding of drought induced tree mortality. To study how water storage impacts tree responses to drought, we studied the cellular structure and function of wood from red maple (Acer rubrum), American beech (Fagus grandifolia), red oak (Quercus rubra), and white pine

(Pinus strobus). We quantified the ability of different wood types to store and release water during drought and how wood formation and anatomy is driven by drought stress. We found variation in wood type and cell size is a driving influence in the total water storage and water released from branches. Additionally, we investigated how xylem of American beech that was formed during a drought year influenced the total water storage and water released from the main stem of the tree. With this information, we are able to determine how drought conditions influence wood anatomy and how that feeds back to influence future responses to drought through water storage dynamics.

821. **Debunking "Erodability": Quantifying Bedrock Fracture Density of the Juneau Icefield, Alaska**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Colby Rand, Undergraduate
Seth Campbell

Faculty Mentor:
Seth Campbell

Abstract:
Traditionally, glacial erosion models rely on a rock's inherent "erodability", typically presented as a constant. However, the erodability of bedrock varies spatially, and the notion of applying a constant erodability term to a whole field site does not fully capture the actual bedrock dynamics of the system. The bedrock's cohesion, or its ability to resist erosion, is usually measured by its fracture density. Measuring the fracture density of recently exposed bedrock gives the best available approximation of the fracture density under a glacier, hereby reflecting the approximate cohesion of the bedrock. In this work, I quantify the fracture density of exposed bedrock on the Juneau Icefield in SE Alaska/NW British Columbia through a combination of field work and modeling. I used drone footage of a nunatak on the icefield collected during the summer 2018 field season and converted this into a 3D Structure from Motion model. This model was then georeferenced with known GPS positions on the nunatak and converted into an orthomosaic. I then employed various machine learning techniques to detect the location of fractures and quantify the spatial variation in fracture density and orientation across the field site. This information can be used to improve glacial erosion models, including the University of Maine Ice Sheet Model (UMISM).

822. **Risk Management Solutions for Brainworm (*Parelaphostrongylus tenuis*) on Farms With Domestic Livestock**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Kayla Whittaker, Undergraduate
Rachel White

Faculty Mentor:
Anne Lichtenwalner

Abstract:
Brainworm (*P. tenuis*) is a parasitic nematode found in meningeal tissues of cervids and other ruminants. White-tailed deer (*Odocoileus virginianus*, WTD) act as a reservoir and definitive host for these parasites. In WTD only, after infective larvae are ingested, they migrate along meningeal tissues without damaging them; once within the WTD skull, adult brainworms deposit their eggs within the venous blood. Immature larvae are passed through deer's fecal pellets, where they will then enter the foot of passing gastropods (intermediate hosts: snails and slugs) and mature into a form that is infective to grazing animals (such as other species of deer, moose, goats, and sheep). These may ingest the gastropods containing infective larvae, which migrate, destroying neural tissue. For these "dead-end" hosts, brainworm infection can be fatal.
This study aims to evaluate brainworm risk to Northeast regional livestock health, and to examine whether optimizing livestock management will decrease the risk of brainworm infection until an antemortem diagnostic test can be found. This project describes a survey tool designed to evaluate farmer practices and awareness of brainworm. Survey question topics cover livestock husbandry, grazing systems, wildlife interactions and the participant's knowledge of *P. tenuis*. The data collected gives insight into where educational efforts would be beneficial to improve livestock management and thus reduce risk. Evaluating these risks and opening a line of communication between researchers and livestock owners could help reduce infection and fatalities caused by *P. tenuis*. This research promotes sustainability by protecting the livelihood of farmers and their livestock.

823. **Control of a Ruminant Pathogen, *Parelaphostrongylus tenuis*, Using Poultry: Effects of Gastropod Diets on Ducks**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Tuuli Overturf, Undergraduate
Rachel White
Ellie Pelletier
Kayla Whittaker
Camryn Chick

Faculty Mentor:
Anne Lichtenwalner

Abstract:
Brainworm (*Parelaphostrongylus tenuis*) is a parasitic nematode that poses a risk to livestock, particularly small ruminants. Its primary host is white-tailed deer (*Odocoileus virginianus*, WTD). The worms reproduce inside WTD, yet WTD are rarely affected. The larvae travel through the deer's digestive system and are shed in feces. The larvae then enter snails (gastropods) and mature into an infective form. Deer or other ruminants ingest the snails and become infected with *P.tenuis.* Unlike in deer, the brainworm larval migration through the central nervous system often kills the host. A proposed method of mitigating risk of *P.tenuis* infection is gastropod control. Introducing ducks is a popular method of control; however, whether eating *P.tenuis*-infected gastropods poses a risk to ducks is unknown.
The goals of this project are to determine whether ducks are an effective control for gastropods, and whether ducks are damaged by ingesting *P.tenuis*-infected gastropods. This will be done via feeding trials; ducks will be fed *P.tenuis*-free snails, *P. tenuis*-infected snails, or *P.tenuis* larvae. Duck health and behavior will be monitored for neurologic damage; feces will also be collected for parasite screening. Necropsies and histology work will be done as necessary. It is expected that ducks will not have neurologic damage nor have larvae in their feces. Evaluating *P.tenuis* risk to ducks and determining whether they are useful for *P.tenuis* control could help inform farmers' decisions about livestock management, potentially leading to lower risk of infection and fatalities resulting from *P. tenuis*.

824. **Global Ocean Surface Temperature Trends: 1982 - 2019**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Terence O'Brien, Undergraduate

Faculty Mentor:
Andrew Thomas

Abstract:
Ocean surface temperatures have impacts on global and local climate and weather events, ocean circulation, marine ecosystems and marine organisms. Thirty eight years (1982-2019) of NOAA Optimum Interpolation Sea Surface Temperature (OISST) 1/4° spatial resolution monthly data are used to quantify global sea surface temperature trends at each grid location over the whole time period and for each ten year (decadal) period within. At each grid location, we calculated the 38 year climatology and each decadal climatology, from which we determine monthly anomalies and then least-squares fit trends.
Over this study period (1982 - 2019) 86% of the global ocean is warming, with 15% warming > 0.25 C/decade, and 0.8% warming > 0.5 C/decade. 14% is cooling, with 0.07% cooling > 0.25C/decade and 0.005% cooling > 0.5 C/decade. The Gulf of Maine shows a trend of warming 0.42 C/decade averaged over the area, with a range of 0.1956 to 0.9826 C/decade.

825. **Improvements on U/Pb Dating Methods for Accessory Minerals**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Joshua S. Stone, Undergraduate
Alicia M. Cruz-Uribe
Hanna L. Brooks
Jesse B. Walters

Faculty Mentor:
Alicia Cruz-Uribe

Abstract:
Accessory phase minerals, such as titanite, can incorporate significant amounts of common Pb (204Pb) into their mineral structures, which leads to uncertainty when applying the U/Pb decay series for geochronology. The isobaric interference between 204Pb and 204Hg creates an additional complexity when calculating common lead corrections. Here we investigate the effectiveness of 204Hg interference removal during U/Pb dating using reaction cell gas chemistry via triple quadrupole mass spectrometry and the impacts on other dating systems, such as Rb/Sr. U-Pb dates for natural titanite reference material BLR-1 and natural zircon reference

material R-33 were determined using an ESI NWR193UC excimer laser coupled with an Agilent 8900 ‘triple quadrupole’ mass spectrometer.
In order to compare traditional methods for U-Pb dating with interference removal methods, two experiments were run, one in which data was collected in NoGas mode, and one in which the 8900 was run in MS/MS mode, in order to assess the feasibility of determining U/Pb ratios with mass shifted isotopes. In MS/MS mode, NH3 not only induces a charge transfer reaction with 204Hg but also alters the U/Pb dates that are calculated. Using He to dilute the amount of NH3 in the reaction cell allows for accurate date determination. Using a low He/NH3 ratio results in inaccurate date determinations; the reported age for R-33 is 419 Ma and the mass-shifted date obtained for R-33 was 405 ± 7 Ma. Conversely, using a high He/NH3 ratio yields a date for R-33 of 416 ± 4 Ma, consistent with reported ages.

826. **Identification of Mastitis Bacteria Species on a Large Dairy Farm using On-farm Polymerase Chain Reaction-based Identification**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Hadley Moore, Undergraduate

Faculty Mentor:
David Marcinkowski

Abstract:
Mastitis poses a huge cost to the dairy industry. It is estimated that mastitis costs the dairy industry $2 billion each year. For farmers, the cost of treating clinical mastitis can range from $347-$422 (Green, Hudson 2013). The main reason for use of antibiotics on dairy farms is to treat mastitis, although some forms of mastitis cannot be treated with antibiotics. The objective of this study is to use an on-farm Polymerase Chain Reaction (PCR) for the use of identifying mastitis organisms on a large dairy farm in Maine. 237 samples total were taken, 88 were fresh heifer samples, 20 were high somatic cell samples and 129 were mastitis samples. Heifer samples were tested for Prototheca and Mycoplasma, mastitis samples and high SCC samples were tested for Streptococcus spp., Streptococcus uberis, Staphylococcus spp., Staphylococcus aureus, Prototheca and Mycoplasma. The Acumen Detection PCR was used to analyze the milk samples. Data was collected from September 5th, 2019 to February 1th, 2020 There were 49 (32%) samples that tested positive for Streptococcus spp., 38 (25%) samples tested positive for Streptococcus uberis, 18 (12%) samples tested positive for Staphylococcus spp., 4 (0.03%) samples tested positive for Staphylococcus aureus, 1 (0.007%) sample tested positive for

Prototheca and 9 (0.06%) samples tested positive for Mycoplasm. There were 36 (24%) samples did not test positive for any of the organisms. Daily milk weights were collected from cows before infection, during treatment, the day after treatment and 30 days after infection. Following infection, cows lost an average of 7.7% daily milk from pre infection levels. With proper use of an on farm PCR, the results of this study show promise for the future of identifying and treating mastitis organisms.

827. **A Study Looking at the Difference in Feeding Behavior Following Calving in Dairy Cows and Possible Correlation in Post-Fresh Milk Production**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Lilla Tilton-Flood, Undergraduate

Faculty Mentor:
David Marcinkowski

Abstract:
The aim of this study was to identify and attempt to isolate any relationship between feeding behavior of fresh dairy cows and milk production in the early part of the lactation cycle. Twelve fresh holstein dairy cows in at least their second lactation were numbered and monitored using cameras. Cameras were attached near the feed bunk area to capture feeding activity and photos were taken every ten minutes for three days following calving. DairyComp data for the twelve cows was retrieved, including 7 day averages post-freshening and 30 day rolling milk averages. It was found that cows more active near the feed bunk had very high milk production in the first part of their lactation.
Transition cow health is of particular interest on dairy farms and management of herd health begins at the onset of the lactation cycle. Cows during this time are most susceptible for the development of both metabolic and infectious diseases. It is important to mitigate any negative effects or diseases the cow can contract at this time and lower the amount of money and drugs delivered. Beginning with the ration of close up cows, inclusion of a balance of minerals and feed components is critical in order to alleviate preventable calving complications. A common cause of issues with fresh cows is lack of delivery of nutrients and energy needed for the onset of lactation causing a negative energy imbalance that develops into metabolic diseases. There was been an ample amount of research regarding behavior at the feed bunk to determine health status of fresh cows (Huzzey et al., 2007; Goldhawk et al., 2009; Proudfoot et al., 2009; Schirmann et al., 2016) along with numerous studies using behavior in general during the transition period

(Proudfoot et al., 2009; Jensen, 2012; Luchterhand, 2014; Llonch et al., 2018; Fujiwara et al., 2019). This study aimed to combine the focuses of both groups of studies to possibly establish any correlation between feeding behavior and milk production in freshly calved cows.

828. **Effect of temperature and soil moisture on biomass growth and allocation in boreal and temperate tree saplings**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Aashish Dhungana, Undergraduate
Nicholas Fisichelli
Ruth Van Kampen

Faculty Mentor:
Jay Wason III

Abstract:
Climate warming and drought are expected to favor temperate tree species from the southern parts of the US over boreal species from northern regions. This study examined the biomass growth of ten boreal and five temperate tree species exposed to different temperatures and soil moisture at two different sites along an elevation gradient in Acadia National Park, ME. The goal of the project was to analyze the biomass growth and allocation to roots and shoots of these species in different climatic conditions. We found that total biomass of temperate and boreal trees declined by 91% and 64%, respectively, as temperature and moisture stress increased. We also found that temperate species allocated more biomass to roots than shoots and at drier sites, both temperate and boreal species allocated more biomass to roots than shoots. Overall, we found a very strong effect of soil moisture on biomass growth and allocation for both temperate and boreal trees suggesting that future droughts may have a profound effect on forest structure and composition.

829. **Bicknell's Thrush distribution in Maine**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Hateya Levesque, Undergraduate
Kaitlyn Wilson
Amber Roth

Faculty Mentor:
Amber Roth

Abstract:
Bicknell's Thrush (Catharus bicknelli) is a rare, range-restricted habitat specialist occurring in balsam fir-dominated montane forests that have been recently disturbed and are undergoing successional growth. While models predicting this species of concern's distribution exist, it is uncertain how reliable these models are in Maine due to the state's unique distribution of tree communities. Additionally, forestry practices may produce suitable habitat characteristics at elevations below the species' historical threshold. Considerable efforts have gone into conducting surveys for Bicknell's Thrush throughout the species' range in Maine, however much of these data exist in separate datasets across numerous organizations. In order to assess the distribution of Bicknell's Thrush and to compare survey data to predicted distributions, this project aimed to consolidate and standardize survey data for the species throughout the state. Additionally, we aimed to compare survey data to models predicting Bicknell's Thrush distribution. To accomplish this, survey data were evaluated based on locations where the species was present or not detected in relation to the predicted distribution model. From this, we have identified the proportion of detections that do and do not coincide with the predicted distribution. Our comparisons of the observed detections to the predicted model provide an estimate of how reliable the distribution model is in Maine and potential discrepancies. Additionally, we used a hot-spot analysis to identify the spatial clustering of detections in the state. From these results, we make conclusions regarding the accuracy of the model and make suggestions for future models predicting Bicknell's Thrush distribution.

830. **Identifying Procurement Zones for Maine's Forest Product Industry**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Noel Lienert, Undergraduate
Anil Raj Kizha

Faculty Mentor:
Anil Raj Kizha

Abstract:
Transportation costs are a crucial element determining the financial viability of raw forest products supply to the end-use facility. Several factors influence the transportation cost including distance to the end-use facility, road network, and payload. This is especially important in Maine, where the forest products industries are scattered throughout the state. The objective of this study was to identify the procurement zones of Maine's sawmills. The forest was broadly classified into species type. Network analysis (in ArcGIS) was used for modeling the procurement zones for 94 mills located within the state. Results showed that mixed forests constituted the majority of the forest lands (over two million hectares). The total road network in the state accounted for over 100,000 km. Approximately, 40% of the forested areas were within one hour of travel time (one-way) to the mills. The transportation time to reach about 21% of the forested lands in the state was between 2-4 hours (one-way). These trips would account for total delivery time (including waiting time at the forest landing and mills) of 5-9 hours, making them a single to double trip per workday, respectively. This information is critical for better planning for both the forest product and management industry.

831. **Application of Oxytetracycline on Buried American Lobster (Homarus americanus) as a Fluorescent Marker for Law Enforcement to Counter Poaching**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Anson Kuzmickas, Undergraduate

Faculty Mentor:
Robert Bayer

Abstract:
A large economic industry surrounds the American Lobster. Maine makes up 80% of the total pounds caught in the nation. With a large influence from Asian nations like China, exports have gone through the roof increasing the price, and bringing money into working families. With significant spending, many have resorted to poaching lobsters from spawning areas or stealing them from traps. Environmental Wardens are looking for ways to reduce poaching incidents. One saving grace might be found in an old antibiotic "Oxytetracycline". This Fluorescent antibiotic is found to bind to Metal Ions calcium and Magnesium. I examine ways to create a

fluorescent marker on lobster for law enforcement to use to stop poaching. Three lobsters are tested with three different variations of the antibiotic to see the best areas and uses for this antibiotic. Creating abrasions on the lobster shell increase the amount of binding conducted by the antibiotic, causing it to keep a strong glow and keep intact for at least three days. This fluorescent marker is strong enough for law enforcement to be able to correctly identify and marked lobster.

832. **Quantification of Mesophyll Variation in V. angustifolium**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Aldous Hofmann, Undergraduate

Faculty Mentor:
YongJiang Zhang

Abstract:
The lowbush or wild blueberry (primarily V. angustifolium) is one of Maine's most important crops and one of four crops native to North America. In previous years the Maine wild blueberry has been facing increasing amounts of environmental pressures and yields have shown a decline in production. Wild blueberries show a large amount of spatial phenotypic variation. In order to make recommendations for precision agriculture the variation between clones must be quantified. In this project we looked at the variation between palisade parenchyma and spongy mesophyll across the clones of Blueberry Hill Farm using ImageJ software. These data were compared to each other and between managed and unmanaged populations. This data was also used to compare to previous years study of xylem anatomy and will be used for future study of genotypic variation.

833. **Pleistocene Epoch Seeds: Connecting the Past to the Future**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Mikayla Mason, Undergraduate
Jacquelyn Gill

Faculty Mentor:
Jacquelyn Gill

Abstract:
The research project, now known as Project 23, unofficially began in 2006 when 16 fossil deposits were discovered during excavation of a new underground parking for the Los Angeles Museum of Art. The fossils discovered included numerous animal remains, including sabertooth tigers, woolly mammoths, and American mastadons, In addition, prolific amounts of macrofossils were found. Today, scientists at a number of American universities are working on Project 23. While much of the research on the animal remains is being undertaken by the scientists and researchers at the La Brea Tar Pits, a large portion of the macrofossil research was conducted at the University of Maine's Climate Change Institute, lead by Professor Jacquelyn L. Gill, Assistant Professor of Paleoecology & Plant Ecology and Katherine C. Glover, Ph.D., Postdoctoral Research Associate. These macrofossils lived during the Last Glacial Maximum (LGM), when ice sheets covered most of North American. Currently, researchers are attempting to use the emerging information to recreate the Pleistocene Epoch landscape, the geological period that occurred approximately 2,588 million to 11,700 million years ago. Once completed, this recreation should improve understanding of how plant families responded to the cooler temperatures and how they evolved over time and help scientists predict which plants are most likely at risk of extinction. This, in turn, will help increase an understanding of modern climate change and determine which plants will be better at adapting to future climate change, including global warming, rising sea levels, and rising carbon levels in the atmosphere.

834. **Ag nanoparticle stability using different reducing agent concentrations**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Robert Patenaude, Undergraduate
Aiden Hale

Faculty Mentor:
Scott Collins

Abstract:
Rapid fluid mixing in microchannels has been a continual quest in microfluidics for over 30 years. Presented here is an ultrafast MEMS-based mixer predicated on a rotating turbine. The mixer is well suited to any application requiring high speed fluidic

mixing but is ideally suited to the study and control of fast sequential chemical reactions, or the synthesis of kinetically controlled, metastable compounds. To demonstrate the utility of the MEMS mixer, monodispersed Ag nanoparticles are synthesized by rapid mixing of AgNO3 with NaBH4. Changing the relative concentration of reagents during synthesis, including the ionic strength, alters the ultimate nanoparticle size distribution and stability.

Nanoparticles were synthesized in a MEMS ultrafast mixer by flowing 0.25mM AgNO3 into 0.75mM sodium citrate and NaBH4 at concentrations between 0.125mM and 0.75mM. After initial synthesis, nanoparticle distributions were Gaussian with peak diameters between 1.1 nm-1.3 nm as determined by Dynamic Light Scattering (DLS). Silver nanoparticles were generally stable, but the diameters slowly increased to 10nm after two weeks. Nanoparticles synthesized with a Ag+ to BH4-concentration ratio at, or below, unity agglutinated quickly (< two days) suggesting a rapid dynamic exchange between Ag+ and Ag0 that leads to digestion of nanoparticles.

835. **Sentinel-2 based prediction of spruce budworm defoliation using red-edge spectral vegetation indices**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):

Rajeev Bhattarai, Graduate
Dr. Parinaz Rahimzadeh-Bajgiran
Dr. Aaron Weiskittel
Dr. David A. MacLean
Dr. Brian Roth

Faculty Mentor:

Parinaz Rahimzadeh-Bajgiran

Abstract:
This research compares the capabilities of various spectral vegetation indices (SVIs) in particular red-edge SVIs to detect and classify spruce budworm (Choristoneura fumiferana) (SBW) defoliation using Sentinel-2 imagery and Support Vector Machine (SVM) and Random Forest (RF) models. The results showed the superiority of RF in model building for defoliation detection and classification into three classes (non-defoliated, light and moderate) with overall errors of 17% and 32%, respectively. The most important variables for the best model were Inverted Red Edge Chlorophyll Index (IRECI), Enhanced Vegetation Index 7 (EVI7),

Normalized Difference Infrared Index 11 (NDII11), MERIS Terrestrial Chlorophyll Index (MTCI), and Modified Simple Ratio (MSR). Red-edge SVIs were more effective variables for light defoliation detection compared to traditional SVIs such as Normalized Difference Vegetation Index (NDVI) and EVI8. These findings can help improve current remote-sensing based SBW defoliation detection and monitoring.

836. **Monarch Butterfly (Danaus plexippus) Migration Roost Site Selection and Vulnerability**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Brandon Boxler, Graduate
Cynthia Loftin
William Sutton

Faculty Mentor:
Cynthia Loftin

Abstract:
The Monarch Butterfly is a flagstone species and pollinator whose populations are declining. Their largest population overwinters in Mexico, then disperses across the eastern United States and Canada during spring and summer. In fall, the butterflies return south. During this migration, Monarchs use two flyways, one in the central United States and one along the Atlantic coast. They fly during the day and at night roost in large groups. The criteria that Monarchs use to select these roost sites are poorly understood. Using modeling algorithms, citizen scientist observations, and environmental variables that affect Monarchs in life stages prior to migration, we developed ecological niche models for the Atlantic flyway roost sites. Proximity to surface water, elevation, and vegetative cover are the most important criteria. We validated the models with data provided from both a smartphone application we developed and distributed to engage citizen scientists in data collection, and peers who assisted in assessing roost habitat suitability at randomly selected locations viewed in Google Earth. We additionally assessed the vulnerability of areas potentially providing suitable roost habitat with respect to anticipated changes in land use and climate, using variables describing exposure, sensitivity, and adaptive capacity, and identified potential conservation areas. The roosts in the Appalachians appear less vulnerable than those nearer the coast. Final products include models of current monarch roost habitat suitability, a risk assessment of stopover areas, and two tools for spatial model validation: a

protocol for model validation with Google Earth and a versatile, easily adaptable smartphone application.

837. **Potential Antimicrobial Activity of Kombucha Fermented by Commercially Available Cultures**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Bouhee Kang, Graduate
Jennifer Perry

Faculty Mentor:
Jennifer Perry

Abstract:
Kombucha, a widely consumed beverage, is obtained from the fermentation of sweetened tea by symbiotic cultures of bacteria and yeast (SCOBY). Kombucha is known to have antimicrobial effects attributed to acetic acids produced during the fermentation and phenolics from tea. This study evaluated the impact of pH and phenolic content on the antimicrobial activity of kombucha. To achieve this, two different types of commercially available SCOBY (NW and N5, 20 g) were separately added into brewed black tea containing 5.4% sugar and 10% vinegar. After the fermentation at room temperature for 10 days, the liquid portion was collected, and the pH was adjusted to incrementally (3-7). Then, the total phenolic content (TPC) and the antimicrobial activity against Escherichia coli 15597, Staphylococcus epidermidis, Listeria innocua, and Vibrio vulnificus were determined using broth microdilution. The significant differences ($p<0.05$) were evaluated using independent t-test. The TPC of both Kombuchas ranged from 150-227 µg/mL gallic acid equivalent (GAE) and were not statistically different within equivalent pH. All inoculated microorganisms were unable to grown at pH 3-5. At pH 6 and 7, V. vulnificus was the most susceptible to Kombucha (minimum inhibitory concentration, MIC 3.2±0.9 µg/mL GAE) followed by S. epidermidis (MIC 10.9±1.5 µg/mL GAE) and E. coli 15597 (MIC 25.8±7.8 µg/mL GAE), respectively. Therefore, our results confirmed that both NW and N5 Kombucha had the potential to inhibit microbial growth and the antimicrobial activity is considered due to the combination of the lowered pH by acetic acids and phenolic compounds.

838. **The Effects of Salt and Garlic Concentration on The Microbial Safety of Spontaneously Fermented Beet Kvass**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Abigail Hing, Graduate
L. Brian Perkins

Faculty Mentor:
Jennifer Perry

Abstract:
Beet kvass is gaining popularity among home fermenters. Efforts to reduce sodium in the form of salt in fermented vegetables, due to adverse health effects, may affect pathogen survival during fermentation, posing a food safety concern. Garlic has antimicrobial properties and could possibly mitigate the safety risk of low sodium fermented vegetables. The objective of this research was to determine the effects of salt and garlic concentration on the microbial safety of beet kvass. Samples of beet kvass with varying levels of salt (0 - 2.5% w/w) and garlic (0 - 1% w/w) were inoculated with two strain mixtures of STEC, Salmonella, and Listeria monocytogenes before fermentation. The survival of these pathogens was assessed at the end of fermentation (pH <4.0) and at the end of 30 days of storage at 4°C. All experiments were conducted in quadruplicate. Data were analyzed with logistical regression for binomial data using R studio. Spontaneous fermentation of beet kvass was insufficient to inactivate any pathogen regardless of salt or garlic concentration. STEC survival rate increased with salt concentration. A significant decrease in survival rate of Salmonella and L. monocytogenes was observed after 30 days of storage. However, these pathogens still had a survival rate of 19% and 33%, respectively. These data suggest that pathogen contamination is a realistic concern and that salt concentration and addition of garlic may be insufficient to mitigate safety risk in beet kvass.

839. **Thermal Inactivation of STEC, L. monocytogenes, and Salmonella in Maple Syrup**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Maria Fiore, Graduate

Faculty Mentor:
Jennifer Perry

Abstract:
The low water activity of maple syrup deems it a lower risk food commodity due to the presumed inhibition of sufficient pathogen growth to induce human illness. However, prior outbreaks caused by foods having this designation, and uncertainty regarding pathogen infectious doses, challenge the current understanding of this perceived inherent safety. Therefore, the objective of this work was to determine the thermal inactivation, defined by D- and z-values, of pathogenic Salmonella, STEC, and L. monocytogenes in maple syrup at normal processing temperatures. Triplicate thin walled capillary tubes were filled with inoculated maple syrup (~5.0 log CFU/ml -two strain composites per pathogen), sealed, and exposed to a 140, 150, or 160°F water bath for preselected timepoints. After three replications, survival points were combined to determine the D-value of each pathogen at the tested temperatures. From the determined decimal reduction times, the z-value equations (log D-value vs. temperature) were plotted for each pathogen, and the kinetics at 180°F, a typical maple syrup bottling temperature, were then computed. The estimated D-values for STEC, Salmonella, and Listeria monocytogenes in maple syrup are 0.47, 1.56, and 4.63 seconds respectively. Therefore, maintaining a 180°F syrup temperature for a minimum 23 seconds, which is well within current processing conditions, is needed to achieve at least a 5-log reduction for all three of the pathogens we analyzed.

840. **Evaluation of Food Safety Messages Translated from YouTube to Home-Canners of Savory Jam**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Alison Brodt, Graduate

Faculty Mentor:
Jennifer Perry

Abstract:
The National Center for Home Food Preservation (NCHFP) gives guidelines on canning safely to decrease the risk of foodborne illness. However, no guidance on savory jam, (jam using a savory main ingredient such as onion), has been developed. Additionally, YouTube has recently emerged as a source of recipes and information for home cooks. Research is needed to see if recipes for savory jam, particularly in the YouTube space, are safe. The objective of this work is

to determine a possible correlation between expertise of video source, and quality of the food safety information given in available videos. Observational data was analyzed using Pearson's product-moment correlation. The total number of safe behaviors shown in videos was significantly positively correlated with the practices of choosing a standard sugar such as sucrose, choosing an ingredient with high acidity, and discussing seasonality in both uncanned and canned savory jam recipes. Concerningly, the number of video views was negatively correlated with the likelihood of washing jars and labeling contents. Expertise was positively correlated with the use of a standard acidulant as well as providing additional information on canning, but the vast majority of videos available were made by sources with the lowest level of expertise. This information will help experts in the field, such as members of Cooperative Extension, better understand contemporary risks in home canning and more effectively direct communication to reach the appropriate target audience.

841. **Impact of blanching on physicochemical, microbial and sensory quality of sugar kelp (Saccharina latissima)**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Samuel Akomea-Frempong, Graduate
Jennifer Perry
Mary Camire
Denise Skonberg

Faculty Mentor:
Jennifer Perry

Abstract:
Blanching is a brief thermal treatment that can be applied prior to further processing to enhance quality but may cause undesired changes in seaweed. This study evaluated the effects of two blanching times on microbial and physicochemical properties of sugar kelp and compared consumer acceptance of seaweed salad made from raw or blanched sugar kelp.
Shredded kelp samples were blanched in boiling water (100ºC) for 0, 1 or 3 minutes. Samples were immediately cooled in an ice-slurry (~1ºC) and evaluated for color (L*, a*, b*), shear force (firmness, N), total phenolic content (TPC), and aerobic plate count. Salads comprising seaweed (78.6%w/w), sesame seeds (20.1%), shredded carrot (1.3%) and Asian vinaigrette (0.15%) were assessed for consumer acceptability (n=102) using a 9-point hedonic scale for color, texture,

flavor, and overall acceptability. ANOVA was used to test for significant differences among treatments ($P \leq 0.05$) and data were further subjected to principal component analysis (PCA). Both blanching treatments significantly increased L* and decreased a*-values, firmness, and TPC compared with raw samples. Aerobic plate counts were low (2.7 log CFU/g) and were not impacted significantly by blanching.
Blanched seaweed salads scored significantly ($P \leq 0.05$) higher for liking of flavor and overall acceptability than raw samples. The color of 1-min blanched kelp salad was rated significantly more acceptable than 3-min blanch and raw samples. PCA showed that L*-values were most associated with sensory characteristics. Overall acceptability was negatively correlated with firmness.
Blanching sugar kelp preserves the quality and makes the product more appealing to consumers

842. **Effects of Elevated Temperatures on Wild Blueberries**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Yu-Ying Chen, Graduate
Pratima Pahadi

Faculty Mentor:
Yongjiang Zhang

Abstract:
Global climate change has already brought challenges to agricultural systems and it is likely that average surface temperatures will increase by another 1.7-4.8 °C at the end of this century. Although warming could potentially benefit some temperate plants, its impacts on wild blueberries (lowbush blueberry) in Maine are not yet known. This research aimed at evaluating the role of warming in altering photosynthesis and water use of wild blueberries. The specific objectives were to 1) Examine whether increased temperatures lead to increased plant water deficits; 2) Quantify photosynthetic rates of wild blueberries under increased temperatures; 3) Characterize changes in plant water use efficiency under warming. Six genotypes differed genetically and physiologically at the Blueberry Hill Farm, Jonesboro ME were selected for this study. Wild blueberry plants in their vegetative growth year were treated with passively-heated open-top chambers (OTC, elevated temperatures by 1.6 °C), actively-heated OTCs (elevated temperatures by 3.7 °C) against an ambient control from May to December 2019. The results showed that warming increased leaf stomatal conductance, transpiration and plant water loss, which consequently decreased leaf water potentials and water availability in the soil. Warming also caused a decrease in leaf photosynthetic

electron transport rates. Overall, our study suggested that the wild blueberry system in a warmer future may need more water supplies (e.g. irrigation) to mitigate the negative effects of warming.

843. **Histamine and Proteolytic Bacteria Levels in the Fermentation of Carcinus maenas**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Delaney Greiner, Graduate
Dr. Denise Skonberg
Dr. Jennifer Perry

Faculty Mentor:
Jennifer Perry

Abstract:
Carcinus maenas (green crab) is an invasive species found on the east coast of North America. Mitigation efforts have focused on finding marketable uses for green crabs, including development of value-added products such as fermented condiments (crab sauce). The purpose of this study was to understand the effect of salt level and fermentation time on the microbial profile and histamine levels in a fermented green crab sauce prototype. Whole crabs were finely chopped in a Kolsch bowl cutter and combined with Kosher salt (10, 20 or 30% w/w). All treatments were prepared in triplicate and fermented at 75oF, then sampled after 60, 90, and 120 days of fermentation. Biogenic amine content was determined by HPLC using a Waters AccQ·Tag. The population of proteolytic bacteria was determined by spread plating on skim milk agar. Data were analyzed by MANOVA followed by Tukey's HSD post hoc test in R studio. No significant differences ($p>0.05$) in histamine content at salt concentrations or time points were observed, the average histamine content being 67.1 ± 16.4 μg/mL, above the legal limit (50ppm). The population of proteolytic microbes was significantly lower in high salt treatments which is associated with longer fermentation times, compared to 10% salt samples. The population of proteolytic bacteria followed a nonlinear trend for all treatments, but reached a maximum of 6.6, 4.8 and 3.5 log CFU/ml in the 10, 20 and 30% salt treatments,

844. **Evaluating Nutrient and Pest Management Strategies for Organic Wild Blueberry Growers in Maine**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Rebecca Gumbrewicz, Graduate

Faculty Mentor:
Lily Calderwood

Abstract:
Given the significant market declines for wild blueberries in the U.S. conventional market, interest in organic production is growing. Growing this crop under certified organic standards is challenging because there are a limited number of fertilizer and pest management tools approved for use.
The effects of various organic amendments on wild blueberry have been previously studied, including biosolids, composts, gypsum, papermill sludge and other fertilizers. Variable effects on soil organic matter, leaf nutrient concentrations, blueberry productivity and marketable yield indicate a need to investigate more alternatives. Improving our understanding of their cost-effectiveness and ability to increase water retention and nutrient availability will aid development of future recommendations to growers.
Effects of a chicken manure, soil, mulch, and compost on wild blueberry (Vaccinium angustifolium and Vaccinium myrtilloides) are to be assessed over a three-year period (two production cycles) between 2019 and 2021. Blueberry plant cover, stem height, and bud count per stem were used to indicate treatment effects on blueberry plant growth during the first field season. Insect, disease, and weed presence were monitored to track changes in pest pressure among treatments. Preliminary analysis of plant growth parameters did not indicate any significant trends this season. Pest pressure analyses indicated significantly higher incidence of grass presence in chicken manure treatments.

845. **Relative risk of soil nutrient depletion among different intensities of biomass removal during timber harvesting in Maine, USA**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Emily Roth, Undergraduate
Ivan Fernandez
Joshua Puhlick

Faculty Mentor:
Joshua Puhlick

Abstract:
This project addresses questions related to soil productivity following contrasting forest management treatments in northern hardwood stands. We calculated Nutrient Stress Indices for estimating the relative risk of forest stands to reduced productivity after tree biomass removal for wood product utilization. Forest soil and other forest attribute data from the Maine Adaptive Silviculture Network were used to conduct the analysis. Nutrient Stress Indices were calculated with data collected in stands before timber harvest. Tree biomass removals were then simulated under different forest management treatments and intensities of biomass utilization. These scenarios were ranked in terms of relative nutrient impact using the pre-treatment Nutrient Stress Indices as benchmarks. In addition to these scenarios, actual biomass removals were assessed for potential impacts on soils. Our findings can provide a tool for risk assessment to soil nutrient depletion from timber harvesting. This information can guide forest management to ensure that long-term forest productivity is maintained in northern hardwood forests.

846. **Examining Honeybee Foraging Preference on Patterned Arrays at a Small Scale**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Henry Laurita, Undergraduate

Faculty Mentor:
Julia McGuire

Abstract:
The honeybee represents the most important vector in the ecology of our food system. As pesticide use, soil erosion and monocropping continue to strain this system, we must seek alternative, ecologically minded solutions. I suggest the intricate patterns developed by the co-evolution of plants and pollinators remains underused in agriculture. Bees forage under predictable “rules” governed by plant density, color, and spacing (among other factors). In this context, I tested a beehive for preference among clumped, uniform and random arrays. I constructed artificial flowers to control for shape, color and reward- these were mounted on array boards that kept density and spacing constant, while allowing flowers to be re-positioned in the above-mentioned patterns. Foraging honeybees were given the choice between two arrays at a time and each array was tested against each other shape. The number of foraging bees were recorded at fixed intervals over the course of nectar depletion and a preference index was compiled. At the scale of this experiment, no statistically significant preferences were revealed, however, suggestions within the data may imply discernible patterns at a larger scale. The

absence of preference at this scale may provide insight into the resolution of the honeybee's dance language. Additionally, this study introduces inexpensive, effective methodology for studying foraging behavior, which lends itself to application in further studies. I believe future research in this vein could provide agriculturists with non-destructive, applicable, effective methods for integrating food systems and ecosystems in a mutually beneficial relationship.

847. **Retroviral Strain Diversity and Spatial Distribution in Wild Turkeys to Assess Agricultural Spillover**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Claudia Desjardins, Undergraduate
Stephanie Shea
Matthew Gonnerman
Erik Blomberg
Kelsey Sullivan
Pauline Kamath

Faculty Mentor:
Pauline Kamath

Abstract:
Reticuloendotheliosis virus (REV) is an oncogenic avian alpharetrovirus that attacks the immune system. This family of viruses is poorly understood, with little data available on the transmission, risks, and clinical signs of infection. Reticuloendotheliosis virus shows very little strain diversity, but the virus can infect a wide variety of wild and domestic avian species. Previous data has shown that REV is globally widespread, with 3-25% of domestic chicken flocks exposed across several countries, justifying concern regarding viral transmission between wild birds and poultry. The overall objectives of this project are to (1) examine the diversity and geographic distribution of REV strains in wild turkeys (Meleagris gallopavo) across the state of Maine, and (2) evaluate the risk of spillover to poultry. We collected blood or bone marrow from live-captured and hunter-harvested wild turkeys, respectively, in Maine. We extracted DNA from the samples, determined REV infection status through PCR procedures, and sent positive PCR products to the University of Maine Sequencing Facility for genetic sequencing. Prevalence of REV in the wild turkey population was estimated and strain diversity was assessed in terms of allelic, haplotype, and nucleotide diversity. A risk map was created to evaluate geographic distribution of REV-infected wild turkeys in relation to agricultural flocks. We expect to find low strain diversity in

REV, significant prevalence throughout the state of Maine, and potential overlap with poultry. This project will provide valuable data to inform disease management in both wild turkeys and poultry.
This project was supported by the Maine Department of Inland Fisheries and Wildlife, Maine Outdoor Heritage Fund, National Wild Turkey Federation, and Maine Agricultural and Forest Experiment Station Hatch Project No. ME021908.

848. **Mites, Camera, Action: An Analysis of the Current Treatment Strategies of Maine Beekeepers for the Parasitic Mite, Varroa destructor**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Patrick Hurley, Undergraduate

Faculty Mentor:
Julia McGuire

Abstract:
The parasitic varroa mite, Varroa destructor (Acari: Varroidae), is currently the most serious threat to honey bee health in the United States and globally. Varroa mites not only drain the life from individual bees but also facilitate disease spread within and between colonies. They are found in nearly every honey bee colony in the United States and can result in total colony loss in 1-3 years if left untreated. A number of mite treatment options are on the market today for U.S. beekeepers, but overwhelming information and often conflicting recommendations leave beekeepers with unclear guidance about difficult and crucial mite treatment decisions. Furthermore, little is known on varroa mite treatment trends and beekeepers' standards within their operations that contribute to mite treatment decisions. This research is intended to be a contribution to the growing body of literature on varroa mite integrated pest management (IPM) through three main components: First, by introducing a new treatment timeline and approach for formic and oxalic acid, two organic acids that are very popular as mite treatments currently; Second, by introducing survey data on Maine beekeepers' mite treatment choices and various factors that contribute to their choices; And lastly, by incorporating feedback from the ever-growing social community of Maine beekeepers through bee club meetings and online groups. The outputs from these combined research components will be informational and decision-making tools that beekeepers in Maine and elsewhere can consult when approaching difficult mite treatment choices.

849. **Predictors and impacts of haemosporidian parasite infections in barn owls (Typo alba)**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Shannon O'Grady, Undergraduate
Olivia Choi
Madison Bangs
Motti Charter
Ran Nathan
Rauri Bowie
Wayne Getz

Faculty Mentor:
Pauline Kamath

Abstract:
Haemosporidian parasites (protozoan parasites infecting blood cells) have been implicated in the declines, and even extinctions of wild bird populations. Parasite infections may have direct effects on host survival. But, in other cases, infections can be sublethal, affecting individual physiology and immunity, which may in turn influence reproduction. Here, we examined the drivers and effects of parasite infections in barn owls (Tyto alba), as the species is known to be infected with chronic infections of avian haemosporidian parasites, but little is known about how disease affects fitness. Our objectives were to (1) examine whether the prevalence and diversity of blood parasite infections differs between male and female owls during the breeding season, and (2) determine whether infection intensity correlates with host reproductive fitness (e.g., clutch size, number of eggs hatched, number of fledglings). Blood and associated data (age, sex, reproductive status, nesting outcomes) were collected from 130 owls during their nesting period. DNA was extracted from blood, and nested and quantitative PCR (qPCR) were used to detect, identify and quantify haemosporidian infections. Statistical analyses are in progress and results not yet available. However, we expect that parasite infection load (abundance) will be inversely correlated with reproductive output. We also expect that parasite loads will differ significantly between males and females, due to large differences in behavior and energy allocation during the nesting period, both of which interact with immune function. The results of this study will be valuable for understanding drivers and indirect effects of parasites on wild birds.

Acknowledgements: This project was supported by the NSF-Ecology and Evolution of Infectious Diseases grant #1617982, Maine Agricultural and Forest Experiment Station Hatch Project No. ME021908, J. Franklin Witter Undergraduate Research Endowment Fund, and a UMaine AY19-

20 Center for Undergraduate Research (CUGR) Fellowship. We thank the Hebrew University in Jerusalem and the Movement Ecology Lab for collecting samples and the Kamath Lab for assistance with the lab work and feedback.

850. **The Remarkable Diversity of Repetitive DNA Composition and Abundance Among Mice**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Caleigh Charlebois, Undergraduate

Faculty Mentor:
Beth Dumont

Abstract:
Repetitive DNA elements were labeled “junk DNA” because they do not encode proteins, but evidence increasingly suggests that dismissing them was premature. Difficulty in assembling repetitive elements and past disregard for their functional implications have created a gap in knowledge: Too little is known about how repetitive elements contribute to genetic and phenotypic differences between organisms. In this project, we determined which 15-mers varied most in frequency among 59 diverse mouse genomes. Our analysis revealed sets of differentially present, highly abundant 15-mers that could be assembled into longer sequences. One sequence, which we named Leitmotif, was present at over 5,000 loci in genomes of Mus pahari and Mus caroli but not present at all in the other mouse genomes analyzed. This element exhibited a pattern of sequence and location that was not consistent with any known class of repetitive element. It had an inverse-repeat structure and appeared to be inserted into known transposable elements. A PCR produced results consistent with the differential presence of sequence A between these mouse strains in vitro. These results indicate that sequence A is a repetitive element which exhibits high differential presence and has not previously been characterized. Further research concerning its association with known transposable elements and its relationship to speciation could contribute to our understanding of repetitive elements in mammals.

851. **Microsite Requirements for Successful Regeneration of Northern White-Cedar in Maine's Lowland Forests**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Jeanette Allogio, Graduate

Faculty Mentor:
Shawn Fraver

Abstract:
Northern white-cedar (Thuja occidentalis) forests serve as important habitat for wildlife and rare plants, provide valuable timber to a specially market, and have long been significant to indigenous peoples for ceremonial and practical purposes. However, recent studies have demonstrated a regeneration bottleneck in which northern white-cedar (hereafter cedar) populations produce abundant seedlings, but these seedlings rarely survive to grow into the canopy, which leads to a decline in cedar-dominant over-stories. While several factors inhibiting cedar regeneration have been identified, a thorough understanding of the conditions that best facilitate regeneration is lacking. The objective of this study is to determine the site conditions that are most favorable to cedar regeneration and survival. This objective is achieved by examining the fine-scale environmental characteristics in which cedar individuals become established, how individuals are arranged relative to each other and the surroundings, and how these patterns differ across size classes. Preliminary results suggest cedar seedlings are most likely to become established on raised mounds, and as seedlings grow into saplings, canopy gaps become important predictors of survival. These findings will be crucial for land managers to develop informed plans that promote and maintain viable cedar forests.

852. **The Effect of Broad-Scale Climate and Microclimate Conditions on Blacklegged Tick Overwintering Survival in Maine**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Michelle Volk, Graduate

Faculty Mentor:
Allison Gardner

Abstract:
Blacklegged ticks (Ixodes scapularis) are the primary vector for Borrelia burgdorferi, the bacteria that causes Lyme disease. Since the first cases in Maine were reported in 1986, Lyme disease has increased in range from southern to northern Maine as the blacklegged tick's optimal habitat has shifted northward with increasing temperature and snowfall due to climate change. Understanding the significance of climate and other ecological drivers to blacklegged tick survival will aid in predicting future distributions of blacklegged tick populations and identifying areas in Maine that pose a risk of Lyme disease to humans. To determine the effects of climate on blacklegged tick survival, we tested tick overwintering survival across latitudinal and coastal-inland climate gradients in Maine and assessed factors contributing to winter mortality both in locations where blacklegged tick populations are currently established and where the blacklegged tick remains undetected. Our results show that leaf litter and snow cover contribute significantly to tick overwintering survival, even at low latitudes, and that ticks overwintering under decreased insulation have a greater mortality than ticks overwintering under leaf litter and snow cover. The results of this study will aid in understanding the climate factors that contribute to blacklegged tick overwintering survival, which has important implications for tick abundance and distribution during the summer. This information can be used to predict the future distribution of the blacklegged tick and tick-borne disease.

853. **Northern Crayfish Have a Larger Impact on Macroinvertebrate Community Composition and Basal Resources than Endangered Juvenile Atlantic salmon**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Nicole Ramberg-Pihl, Graduate
Steve Coghlan
Joseph Zydlewski
Keegan Feero
Hamish Greig

Faculty Mentor:
Hamish Greig & Steve Coghlan

Abstract:
Interactions between macroconsumers in freshwater environments often drive broadscale patterns observed in community composition and basal resources. We conducted an in-stream experiment examining how interactions between endangered juvenile Atlantic salmon, Salmo salar, and northern crayfish, Faxonius virilis, impacted the surrounding macroinvertebrate community, as well as leaf litter breakdown, and algal growth. In the summer of 2018, 24 stream channels lined with cobble, each containing 2 leaf packs and 4 algal tiles, were placed in Sunkhaze Stream (Milford, ME). Channels were naturally colonized with macroinvertebrates before being assigned to 1 of 4 treatments: salmon, crayfish, salmon and crayfish, or salmon/crayfish free. After 3 weeks, all salmon and crayfish individuals were removed from the channels. Invertebrates from both the cobble substrate and leaf packs were collected, along with the leaf packs and algal tiles. We found that crayfish presence significantly impacted invertebrate community composition and resulted in lower familial richness in the cobble samples. Furthermore, we observed significantly higher rates of leaf litter breakdown when crayfish were present compared to significantly lower rates of leaf litter breakdown when salmon were present. Lastly, crayfish presence resulted in significantly higher amounts of algal biomass. Our results suggest that the crayfish, a macro consumer filling multiple functional roles, has a greater impact on stream food webs than juvenile Atlantic salmon, a predator. This research furthers our understanding of the roles that salmon and crayfish play in food web dynamics, which is crucial if we are to properly inform salmon recovery efforts.

854. **Equipment Selection A Bridge Between Financial Feasibility and Productivity for Small Woodland Owners**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Ashish Alex, Graduate
Anil Raj Kizha

Faculty Mentor:
Anil Raj Kizha

Abstract:
Small woodland operations are often limited to fewer options in terms of timber harvesting equipment selection compared to their industrial counterparts. This is primarily due to lower volume of wood harvested which would be a major financial constraint to support more productive equipment. Semi-mechanized operations have lesser operational cost; however,

drastically lower in productivity. Detailed time motion study was conducted for a semi-mechanized tree-length harvesting system using chainsaw and cable skidder to understand its feasibility in small scale operations. Delay-free cycle (DFC) time was recorded in seconds using a stopwatch; equipment information was collected to calculate hourly machine rate cost using standard machine rate calculation methods. The study site consisted of pre-commercially thinned (PCT, 18 acres) and unthinned (UT, 5 acres) areas. Average DFC time per felling cycle in PCT and UT were 1.22 ± 0.08 and 1.21 ± 0.11 minutes. Average DFC time of skidder was 26.27 ± 1.35 minutes in PCT and 22.43 ± 1.33 minutes in UT. Average skidding distance was 171 ± 22 m in PCT and 81 ± 20 m in UT. Hourly machine rate for chainsaw and skidder was $14.32 and 131.69 per Productive Machine Hours (PMH) respectively. Using industrial level rates, the operation was estimated to be at $ 36.21 and 88.90 per PMH respectively. Compared to fully mechanized whole-tree operations, the hourly machine rate cost was lower for this operation, suggesting semi-mechanized tree-length method could be a better option for small scale woodland owners.

855. **Regulatory Frameworks and the Role of Land Grant Institutions in the Legalized Cannabis Edibles Market**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Abigail Wiegand, Graduate

Faculty Mentor:
Jennifer Perry

Abstract:
States have been legalizing recreational marijuana one by one since 2012, while it remains federally illegal. Consequently, oversight and regulation of the industry vary widely between states. There is confusion around the legality of providing information and support to legal marijuana businesses. The purpose of this study is to gather information on how institutions within each of those states are interacting with the industry, with a particular focus on food products infused with marijuana. The buying and selling of any food without proper oversight is a safety risk to consumers and a legal risk to producers and sellers. Representatives at Land Grant universities, Cooperative Extensions, and State Departments of Agriculture were contacted for recruitment in a phone interview on this subject. Policies and information publicly available online were also obtained and characterized. Generally, regulatory bodies were more forthcoming with information. Universities and Extensions, who rely on federal funding, were

more hesitant. Regardless of federal status, the legal marijuana industry is thriving. More objective research is needed to protect stakeholders and consumers. The focus of studies and policies has been on smoke-able marijuana, leaving a lack of information about other forms of ingestion.

856. **The effects of timber harvesting on Ixodes scapularis abundance and tick-borne pathogen transmission in Maine**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Stephanie Hurd, Graduate
Laura Kenefic
Jessica Leahy
Andrew Richley
Carly Sponarski

Faculty Mentor:
Allison Gardner

Abstract:
Lyme disease poses an immediate and expanding threat to public health, with tens of thousands of cases reported annually in the U.S. The blacklegged tick (Ixodes scapularis) is the principal vector for the bacterium (Borrelia burgdorferi), that causes this disease. Many wildlife species are important hosts for I. scapularis (e.g., white-tailed deer), natural reservoirs for B. burgdorferi (e.g., white-footed mice), or both. When the tick is not feeding on small or large mammals, it lives in the microhabitat of leaf litter. Yet although the Lyme disease transmission cycle is deeply embedded in the forest ecosystem, there has been limited investigation into the effects of forest management on vector abundance and disease transmission. Timber harvesting opens the forest canopy and alters the microclimate near the forest floor, potentially causing an ecological cascade in which changes in microhabitat and wildlife communities alter tick density, pathogen infection prevalence, and Lyme disease exposure risk. This study tests the specific hypotheses that different intensities of harvesting (no harvest within the past 25 years, low harvest intensity, and high harvest intensity) will variably affect 1) tick density, 2) vertebrate host diversity, 3) microhabitat features, and 4) pathogen prevalence. To test these hypotheses we collect ticks, trap small mammals, deploy trail cameras to quantify large mammals, characterize microhabitat, and utilize pathogen testing to determine nymphal tick infection prevalence. Our goal is to develop

forest management guidelines that facilitate or inhibit disease transmission. Determining the underlying mechanisms of Lyme transmission will aid in the mitigation of human-disease risk.

857. **Woody Biomass Harvest: Comparing Conventional with Exclusive Cost Apportioning Methods**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
Libin Thaikkattil Louis, Graduate
Anil Raj Kizha

Faculty Mentor:
Anil Raj Kizha

Abstract:
Cost of at-landing biomass operation is a function of several factors including harvesting methods, stand condition, and proximity to end use facilities. This operational cost can also substantially fluctuate depending on the cost apportioning method used. However, currently there are no approach to calculate the cost of biomass operations as a part of service contract. The objectives of the study were 1) to estimate the cost of producing pulpwood chips exclusively from small-diameter trees (DBH < 5 inches); and 2) to compare and estimate cost of producing sawlog and chips (from hardwood pulp) with three cost apportioning methods. The study was carried out on an industrial timberland property in Northern Maine, USA during the summer of 2018. Detailed time and motion study was conducted for all in-wood operational phases. The cost of producing wood chips from pulpwood as by-product was (US$ 3.07 m-3) half of the cost calculated using joint-products allocation method (US$ 7.65 m-3). The cost of producing wood chips utilizing exclusive product allocation (US$ 47.53 m-3) was four times the cost of producing sawlogs (US$ 11.23 m-3). This study will provide working values that can enable landowners and operational foresters to evaluate the cost of harvesting woody biomass under different market conditions (i.e., demand for woody biomass).

858. **Surface modification of Cellulose NanoFibers for developing high water resistance packaging film for food products**

Submission Type: Oral Presentation
Submission Category: Natural Sciences

Author(s):
SuriyaPrakaash LakshmiBalasubramaniam, Graduate
Balunkeswar Nayak
Avinash Singh Patel

Faculty Mentor:
Balunkeswar Nayak

Abstract:
Cellulose Nanofibers (CNF) have been increasingly investigated as an alternative to plastic packages. In spite of their excellent mechanical properties, their hydrophilic nature adversely affects their application as a food packaging component. Modification can improve their hydrophobicity; however, they form poor films. In this study, we investigated the modification of premade CNF films using modification routes that aimed to preserve the films' mechanical properties while maintaining hydrophobicity. Two modification routes were followed: in the first route, CNF films were completely submerged in a hot pyridine/acyl chloride solution. In the second route, acyl chlorides were applied on the surfaces of hot pyridine-swollen CNF films. Both films resulted in surface hydrophobicity; the films that were formed through the second route improved the properties of the water vapor barrier significantly ($p<0.05$). The first route, however, resulted in modified films that better preserved their mechanical properties. Hence, from this study, it can be concluded that it is possible to improve the hydrophobicity of CNF films without affecting their mechanical properties.

859. **Establishing the Connection Between White Adipose Tissue Sensory Innervation and Energy Balance**

Submission Type: Poster
Submission Category: Natural Sciences

Author(s):
Dylan Taplin, Undergraduate
Cory Johnson
Kristy Townsend

Faculty Mentor:
Kristy Townsend

Abstract:
Obesity and its co-morbidities are a prevalent and proliferating problem worldwide, especially in the United States, where the CDC reports 4 in every 10 people are obese. Energy balance is regulated through modifying energy expenditure (including thermogenesis) and energy intake

(including appetite). Excess energy is stored as lipid in white adipose tissue (WAT), to be later used as fuel. Previously, our lab found that dietary fat enrichment with specific fatty acids altered the lipid composition of WAT in mice. Through unbiased lipidomics of WAT, we found that mice fed omega-6 polyunsaturated fatty acid (PUFA) enriched diets displayed larger breadth in signaling lipid species than mice fed diets enriched with either omega-3 PUFA or saturated fatty acid. Additionally, some significantly abundant lipids found with certain diets are known to modulate nerve activity. WAT is innervated by the peripheral nervous system, which is a potent regulator of lipid storage and lipid usage in WAT. Sensory nerves, a subcategory of peripheral nerves, are thought to function as fuel sensors in WAT. However, the mechanisms of sensory nerves as fuel sensors are largely understudied. Interestingly, (omega-6 polyunsaturated fatty acids) O6-PUFA derivative 13-Hydroxyoctadecadienoic acid (13-HODE), a known agonist of the sensory nerve cation channel TRPV1, was found to be in high abundance in WAT after omega-6 PUFA enrichment. We believe this lipid may act as a fuel status signal by initiating brain-adipose communication through sensory nerves in WAT via activation of transient receptor potential cation channel subfamily V member 1 (TRPV1). We have visualized 13-HODE mediated nerve activation using intravital calcium imaging in mouse WAT. To further understand sensory nerve involvement of energy balance in WAT, we have begun immunostaining to characterize WAT sensory nerves and have conducted a novel study to investigate the effects of cold exposure, used to promote lipid usage in WAT for energy, on both the proteome and the neuropeptidome of WAT. Here, we discuss these most recent inquiries.

Interdisciplinary Research

Projects 901 - 911

Interdisciplinary Research

901. **A Sustainable Approach to Food Waste Management: The Triple Bottom Line for Food Based Businesses in Maine and Beyond**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Kathleen Tims, Undergraduate
Stephanie Ayotte
Peter O'Brien

Faculty Mentor:
Susanne Lee

Abstract:
Approximately 40% of food produced is not eaten; a trend increasing in Maine and the United States (Harvard Food Law Policy, 2014). This loss comes with significant economic, environmental and social costs. Worldwide and national goals have been set to reverse this trend; the Environmental Protection Agency set a 2030 target to reduce food waste by 50%. Our interdisciplinary, student-driven research team is in a unique position to tackle this problem by drawing on our collective knowledge of business, biology, economics, and engineering. By engaging key Maine food system stakeholders and creating the “Maine Food Production Leadership Council” (MFPLC), we aim to find a sustainable approach to food waste management that delivers triple bottom line results benefiting the planet, people, and profits. Our first MFPLC workshop identified the needs and barriers of Maine food-based businesses with regards to sustainable food production and distribution. Following the first meeting, we targeted best practice solutions that improve communication, improve capacity across food supply chains, clarify legal regulations, and incentivize action by Maine businesses. We will propose these solutions at a second MFPLC working session in March of 2020. The goal is to gather feedback and gain support to implement solutions. These solutions include data matching software, labeling and certification programs, and investment towards Maine’s storage and transportation infrastructure. The next steps to mitigate food waste environmental impact, reduce operating costs, and fight food security in the state of Maine will be presented to the Mitchell Center in May 2020.

902. **Progressive Accessibility: Using Forensic Analysis to Eliminate Barriers**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Alia Shaw, Undergraduate
Hailey Perry

Faculty Mentor:
Elizabeth DePoy

Abstract:
Accessibility is most frequently thought about as measures to include people with impairments in a standardized world. This poster presents a unique research method, forensic or failure analysis, that was used to examine barriers to access not typically considered in accessibility efforts. Forensic analysis originated in criminal justice where errors in committing a crime were sought to identify culprits. The inductive techniques have been extrapolated to research in areas such as engineering, digital development, and most recently in social sciences, arts, and humanities. Looking at what fails provides important evidence for redesign and social change research and action.
The conceptual framework that houses forensic analysis in this research targeted at informing efforts to eliminate access barriers, asks us to look at access as a tripartite construct that begins with awareness of barriers, proceeds to fostering partial but not equal inclusion (e.g. accommodation and compliance with non-discrimination legislation), to the desirable of full participation without the need for disability specific accommodations, rules, and laws.
Forensic analysis in this work answered the following four questions:
Why does a product, program, effort, space, social context fail?
How does a product, program, effort, space, social context not fail?
How can failure and “not failure” identify a path for change?
What are the processes and outcomes of the change and how are they achieved?

This poster focuses on the forensic research and innovative solutions to access barriers in four areas: information, voting, higher education, and presence in the public-eye.

903. Undesigning Stigma; Motorized Wheelchair for All?

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Meghan O'Neil, Undergraduate
DIS300 Class

Faculty Mentor:
Elizabeth Depoy and Stephen Gilson

Abstract:
In this poster, we present the aggregate results of a course research project on innovative undesign and redesign of the motorized wheelchair. Undesign does not call for the absence of intentional design, but rather is a school of thought and praxis that re-visions aesthetics and function as equal partners, without the near-sighted focus on prescribed style, fad, sameness, or fragmentation. Given, that wheelchairs are among the equipment most highly stigmatized, emblematic of debility and dependence, and existentially and aesthetically feared in the visual and social climate of 2020, students in DIS 300 engaged in the undesign and then redesign of motorized wheelchairs using four design principles:
Seamlessness, defined as continuity.
Elegance, an attribute that does extensive work without obfuscation or ostentation.
Skepticism, a model of philosophical skepticism as an ongoing and exhaustive questioning process, eliminating the potential for complacency or acceptance of a single monistic truth
Polyphany, many voices and opinions
This poster shares the innovative research, thinking, and designs of the class. Students attended to expansion of the motorized wheelchair away from disability-specific equipment to a mode of transportation. The designs features and attributes exhibit elegant and seamless principles. Of particular note is the attention given to how a stigmatized piece of equipment, with creative research and design thinking can be developed into a transportation device used by ambulatory and non-ambulatory individuals alike, in diverse contexts and environments, and embodying contemporary aesthetic properties such that the design is appealing to view, seek, and use.

904. **Working as a Team and How to Succeed: An Interdisciplinary Approach to Reducing Food Waste**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Jordan Lamkins, Undergraduate
Hannah Nadeau
Kendall Willard

Natalie Thomsen
Anthony Sutton
Deborah Saber

Faculty Mentor:
Deborah Saber

Abstract:
Focus: Siloed research starts at the undergraduate level when students become immersed in their programs and learn disciplinary jargon and methodological procedures. However, as young professionals prepare for the workforce, employers expect candidates to communicate across demographics and disciplines. Conducting interdisciplinary research during undergraduate years allows students to work across different fields of study while pulling from discipline specific experiences. Process: We highlight our team process of uniting discipline specific research by focusing on food waste--a “wicked” problem, which acknowledges how multifaceted problems require interdisciplinarity. Collaboration can be inhibited from the outset as research silos also impact the times available for meeting due differences in labs and or standard coursework (e.g., engineering students typically fill afternoons with laboratory classes that are scheduled up to 3 times a week, and nursing students can begin 8 - 12-hour clinical courses at 6:00 am). To work through this, we created a physical and virtual space that supported ongoing engagement form students, while fostering a supportive environment committed to interdisciplinary work with food waste. Outcomes: Ongoing meeting conversations provided an interdisciplinary venue to avoid siloed work as students discuss the methods of their discipline, how they collect data, and what a solution looks like within their field of study. Our strategies for composing abstracts, presentations, and writing projects provided opportunities where the team worked across disciplines to meet deadlines and produce high-quality outputs. Through perseverance, undergraduate interdisciplinary research provides essential workforce development and creates an enriched college experience.

905. **Thermal Expansion and Residual Strain Effects in AlN Thin Film Sensor Materials**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
David Plouff, Undergraduate
Morton Greenslit
Mauricio Pereira da Cunha
Robert J. Lad

Faculty Mentor:
Robert J. Lad

Abstract:
Aluminum nitride films are attractive materials for high temperature sensor devices because of their stable piezoelectric and semiconducting properties up to 800ºC in air, above which the films degrade by oxidation. In this work, epitaxial AlN (002) films were grown at 930ºC on c-cut sapphire substrates by N2-plasma-assisted Al evaporation and were characterized up to 1000ºC in air using an X-ray diffraction (XRD) sample hot stage. The coefficient of thermal expansion (CTE) was determined from accurate measurements of the c-axis lattice parameter for AlN and sapphire during thermal cycling between 30-700ºC, and film oxidation was evaluated above 700ºC from the relative decrease in the AlN (002) XRD intensity. AlN films grown to 300 nm thickness have c-axis compressive strain, but this residual strain can be relieved and or become tensile by thermal cycling. The CTE values of 1.4-2.5x10-6/ºC for the as-deposited films decreased as the film strain was released and is below the value of 4.2x10-6/ºC reported for bulk AlN. Understanding the level of residual film strain and thermal expansion matching across the relevant interfaces is key for preventing delamination, cracking, and failure of sensor components while being used under high temperature harsh environment conditions.

906. Enteric microflora dysbiosis: Impact on sleep fragmentation and mild cognitive impairment in aging adults

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Ben Williams, Undergraduate
Jessica Aronis
Chris Gilbert
Marta Herzog
Gabriella Cyr
Bailey Carter

Faculty Mentor:
Marie Hayes

Abstract:
It is projected that, by 2050, the global prevalence of Alzheimer’s Disease (AD) will reach 106.4 million. Given that Maine is the most elderly U.S. state by percentage, AD has the potential to

become a public health crisis. Previous studies on the pathophysiological mechanisms of early AD, or Mild Cognitive Impairment (MCI), have determined that sleep and circadian rhythm disorders in MCI are common. In addition, MCI risk is increased by a Western diet characterized by high fat and sugar intake. A known bidirectional relationship between the human brain and intestinal microflora, coined the gut-brain-axis, has provoked researchers to examine the correlation between sleep, diet, and neurological disorders. In this study, MCI and cognitively normal aging adults (N=96; 60-90 years of age) were examined with 7-days of actigraphy for sleep patterning. Diet was examined using the Dietary Fat and Free Sugar - Short Questionnaire (DFS) in order to assess the impact of diet-induced enteric microflora dysbiosis on sleep fragmentation. While the DFS is not capable of confirming gut dysbiosis, participants were categorized as “Likely At Risk” or “Likely Not At Risk” for gut dysbiosis based on DFS responses in accordance to USDA 2020 Dietary Guidelines. Multivariate statistical analyses were utilized to determine the correlation between the quality of the aging adults’ diets and brief, intermittent sleep arousals. Preliminary results show that poor nutritional habits are associated with elevated sleep fragmentation as well as MCI status.

907. **Designing a Crowdsourced Website to Make Math Easier**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Spencer Ward, Undergraduate

Faculty Mentor:
Justin Dimmel

Abstract:
Nobody knows how people learn math. Education researchers have been able to identify effective ways of teaching it, and neuroscientists have offered insight into the way it works in the brain, but at best, educators have only heuristics approximating students' comprehension of new topics. Work done in the field of embodied cognition, a branch of cognitive science that emphasizes the experiential basis of cognitive structures, complicates matters further by suggesting that learner comprehension could be as varied as the learners' life experiences. For the time being, it seems reasonable to suspect that the full complexity teaching could be beyond comprehension.
In that sense, real change in math education may be dominated by evolutionary processes taking place at scale as students impact individual educators, and as individual educators impact their peers. At present, traditional classrooms are effective at supporting responsive and creative

education techniques on small scales, and academic research can spreads small scale wisdom with other educators, but they lack the centrality needed to attract large scale collaboration. Online options like Wikipedia and Wolfram MathWorld offer the benefit of centralizing collaboration among educators, but they fail to take advantage of student feedback.
This project will propose a website design meant to support centralized collaboration among educators while preserving the data generated in learner experiences. Features will be proposed to track the success of individual parts of explanations and compare competing explanations. Collaboration tools will emphasize experimentation and critique. The final design will be developed after the author's graduation.

908. **Protecting the Last Stronghold: Climate Change Adaptation Strategies for Wild Maine Brook Trout**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Jennifer Smith-Mayo, Graduate

Faculty Mentor:
Bridie McGreavy

Abstract:
In the Eastern United States, native brook trout (Salvelinus fontinalis) populations are in critical decline due to causes such as climate change, acid rain, non-native species introduction, overfishing, sedimentation, fragmentation, and pollution. Maine is home to the last “extensive intact populations of wild, self-producing, brook trout in lakes and ponds” in the contiguous United States. Wild brook trout have lived in Maine since the last glacial retreat, approximately 9,000 to 10,000 years ago, and are an indicator species of a healthy ecosystem. A member of the charr family, brook trout have adapted to thrive in brooks, streams, ponds, lakes, and the ocean, but for survival, need clean, cool, well-oxygenated water, and gravel spawning beds near percolating groundwater or springs, free of sediment and pollution. Native Americans, especially the Aroostook Band of Micmacs, depend on fishing for wild brook trout as a culturally significant food source. As the climate changes, brook trout face significant risk of losing precious cold-water habitat due to warming water temperatures, pollution, contamination, and reduction in stream flow. An increase in water temperatures, especially in streams, stresses brook trout, which can be fatal. This research disseminates current and future strategies for native brook trout protection through fieldwork, interviews, and a literature survey. These strategies include: environmental DNA (eDNA) detection, the Remote Ponds Project survey, the Micmac

Farms brook trout hatchery, the Maine Heritage Fish Sign Project, the Advanced Partnerships Project (in development), climate change monitoring, population status evaluation, and catch-and-release and restraint angling practices.

909. **Using Unmanned Aerial Vehicles and Automated Detection Processes to Monitor Colonial Seabirds on Maine's Coastal Islands**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Logan R. Kline, Graduate
Meredith Lewis
Lauren Maher
Alexander Revello
Dr. Daniel Hayes

Faculty Mentor:
Cynthia Loftin

Abstract:
Coastal ecosystems face constant pressure from anthropogenic threats such as sea level rise and habitat degradation. Seabirds function as indicators of coastal ecosystem health; however, traditional survey methods have limitations in observer errors and visibility bias and may cause disturbance to nesting birds. Recently, Unmanned Aerial Vehicles (UAVs) have been used in monitoring wildlife populations, including nesting seabirds and long-legged waterbirds. Lightweight, programmable for automated flight, and able to accommodate navigational and photographic instruments, UAVs offer a solution to limitations of traditional surveys such as minimizing disturbance created during ground surveys. These advantages also have costs, however, such as the sheer amount of labor required to manually process the recorded imagery. The development of automated image processing tools for object detection and classification with artificial intelligence offers promise, however issues persist in the application of this technology on a broad scale. Additionally, a streamlined, user-friendly tool is needed for biologists and citizen scientists to efficiently apply automated image analysis processes. The goal of our research is to develop accurate and efficient automated processes for estimating colonial nesting seabird and waterbird abundance from plane- and UAV-based imagery as well as ground-based counts of seabird populations within the Gulf of Maine region. The high-resolution plane- and UAV-based imagery will be supplemented with ground counts to validate the automated interpretation of multiple bird species and behaviors. Our goal is to understand

sources and amounts of errors in population estimates developed from these survey platforms, leading to improved accuracy.

910. **Methodology for the Use of Unmanned Aerial Vehicles in Colonial Waterbird Population Studies**

Submission Type: Poster
Submission Category: Interdisciplinary Research

Author(s):
Meredith Lewis, Graduate
Logan Kline
Alex Revello
Lauren Maher
Daniel Hayes

Faculty Mentor:
Cynthia Loftin

Abstract:
Colonial waterbirds are in decline worldwide due to habitat destruction, changes in fishing regimes, and climate change. Gathering accurate estimates of abundance, distribution, and productivity are central to understanding the effects of stressors on colonial waterbirds and informing conservation decisions. Plane-based imagery and ground counts are integral for gathering population data for these species. However, ground counts can introduce high levels of disturbance, and plane-based surveys are not applicable to all species. Unmanned Aerial Vehicles (UAVs) offer greater image resolution, reduced potential of observers damaging chicks and nests, and may reduce predation caused by disturbance. However, species-specific protocols for UAVs are poorly developed, particularly with respect to minimizing disturbance during surveys and accounting for detection probability in estimates derived from imagery. This research addresses these gaps by implementing hierarchical models, such as n-mixture models, to gather robust estimates of waterbird abundance and productivity. We will compare abundance estimates between plane, UAV, and ground-based surveys. We will evaluate how UAVs affect bird behavior based on flight parameters such as height above the ground. This research will not only estimate colonial waterbird abundance on Gulf of Maine islands and coastal areas, but will contribute to protocol development for future use of UAVs in avian population studies beyond the Gulf of Maine.

911. **Transcriptomic Variation Underlying Resistance to Pollution in Fish**

Submission Type: Oral Presentation
Submission Category: Interdisciplinary Research

Author(s):
Anna Briley, Undergraduate
Akila Harishchandra
Casey Lindberg
Richard T. Di Giulio

Faculty Mentor:
Nishad Jayasandara

Abstract:
Polycyclic aromatic hydrocarbons (PAHs) are highly toxic persistent organic pollutants. A population of Atlantic killifish, Fundulus heteroclitus, in the Elizabeth River, VA have evolved complete resistance to these chemicals. For example, they are resistant to developmental cardiac deformities resulting from PAH exposure. However, the current understanding of the molecular mechanisms underlying this resistant phenotype is incomplete. The goal of this research was to identify differential gene expression patterns between PAH-resistant embryos and PAH-sensitive embryos, reared under clean conditions and exposed to PAHs. Embryos were collected at seven days and at 14 days during development and a RNAseq analysis was conducted. Data showed >30,000 differentially expressed genes across all the conditions tested. More specifically, we found a variety of PAH-metabolizing enzymes involved in hydroxylation reactions and conjugation are implicated in sensitive fish exposure to PAH's. These enzymes include glutathione-disulfide reductase, glutathione S-transferase, and cytochrome P450, all of which also produce reactive metabolites capable of harming the cell. While these detoxifying enzymes are upregulated in PAH-sensitive embryos exposed to PAHs, there is a lower expression of corresponding genes in the PAH-resistant embryos. These results suggest down-regulation of this key metabolic pathway and preventing formation of intermediate harmful metabolites appears to underpin PAH-resistance. Our next step is to develop bioinformatics pipelines to further explore other unknown pathways linked to PAH-resistance in these fish.

Biomedical Sciences

Projects 1001 - 1078

Biomedical Sciences

1001. **An Array of Synthetically Produced Fluorescent Biomarkers for Monitoring Neutrophil Behavior in the Non-Specific Immune Response**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Miranda Jacques, Undergraduate
Siham Hattab
Robert Wheeler

Faculty Mentor:
Matthew Brichacek

Abstract:
Currently, in order to study neutrophils, researchers must genetically modify a species to express fluorescent genes which is a time-consuming process. As a solution, fluorescent molecular biomarkers are being explored due to their usefulness in bioimaging because using a molecular probe is a non-invasive method for studying the natural response of cellular systems. In this study, an FPR receptor-specific peptide, cFLFLFK, was synthesized using an automatic peptide synthesizer and the peptide produced was chemically modified with a PEG attachment for optimal solubility and increased bioavailability. The resulting compound was then further modified through the attachment of various fluorophores spanning the UV-vis spectrum, including Cyanine 3.5 (580/605nm) and AlphaFluor ® 488 (488/520nm) which have emission wavelengths comparable to the mCherry (488/505nm) and GFP (595/605nm) proteins expressed in genetically modified specimens. These molecular probes were then purified using a size exclusion column and characterized via UV-Vis spectroscopy and MALDI mass spectrometry. To assess biocompatibility and aqueous availability, each probe was then evaluated in an embryonic zebrafish model. Overall, the successful synthesis of a variety of biomarkers allows for the future manufacturing of these biomarkers to enable fast and non-invasive immunology research regarding neutrophils.

1002. **The Role of the BPs Immunity Repressor in the Regulation of Pathogenic Mycobacterium chelonae Gene Expression**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Emma Freeman, Undergraduate
Jaycee Cushman
Sarai Smith
Sarah McCallister
Keith Hutchison

Faculty Mentor:
Sally Molloy

Abstract:
Mycobacterium tuberculosis is the leading cause of death by an infectious disease. In 2018, 10 million people developed tuberculosis and 500,00 cases were resistant to antibiotics (WHO, 2019). All members of the M. tuberculosis complex are lysogens, meaning they carry prophage, or integrated viral genomes within the host genome (Fan, et al. 2015). However, the non-pathogenic vaccine strain lacks prophage, which suggests a prophage role in virulence (Fan, et al. 2015). Because not all prophage encode obvious virulence genes, we hypothesize that prophage impact bacterial virulence by altering host gene expression. By studying gene expression in M. chelonae, a relative of M. tuberculosis, in the presence and absence of prophage BPs, we determined prophage impact mycobacterial gene expression. Through RNAseq analysis of M. chelonae with or without prophage, we detected changes in expression of 7.7% of M. chelonae genes, including the gene whiB7, which is involved in antibiotic resistance. During lysogenic infection of M. chelonae the most highly expressed BPs gene was the immunity repressor (gp33). To determine if viral gene products drive changes in expression of whiB7, strains of M. chelonae that express gp33 were created and gene expression and antibiotic resistance analyses were performed. Expression of gp33 did not alter expression of M. chelonae whiB7 nor antibiotic resistance. We are now investigating alternative hypotheses to explain how prophage alter whiB7 expression.

1003. **The role of BPs' gp33 immunity repressor in the downregulation of Mycobacterium chelonae genes**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Anna Schumann, Undergraduate
Dakota Archambault

Faculty Mentor:
Sally Molloy

Abstract:
Pathogenic mycobacteria are the leading cause of death worldwide. Mycobacterium abscessus causes lung infections and often is completely resistant to antibiotics. Increased research on antibiotic resistance mechanisms is important for developing new treatments. Prophage, viral genomes integrated into bacterial genomes, contribute to virulence in most pathogens M. chelonae determined that prophage BPs alters expression of 7.4% of bacterial genes. M. chelonae carrying prophage BPs also has increased antibiotic resistance. It has not been reported how prophage changes bacterial gene expression and antibiotic resistance. Prophage gene products may alter bacterial gene expression. Prophage BPs expresses high levels of a repressor that binds to the regulatory regions of BPs lytic genes to prevent their expression. We identified similar repressor binding sites in the regulatory regions of four M. chelonae genes that are downregulated in the presence of BPs, one of which may contribute to antibiotic resistance. This project aims to determine if the repressor binds to M. chelonae sequences to downregulate expression by creating a reporter plasmid that can detect expression from the four regulatory sequences in the presence and absence of the BPs repressor. We have PCR amplified the four regulatory sequences, and four negative control sequences. We are currently inserting those sequences using Gibson cloning, into the reporter plasmid encoding a green-fluorescent protein (GFP).

1004. **Investigating the role of Group B Streptococcus prophages on bacterial fitness and virulence**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Amelia St. John , Undergraduate
Caitlin Wiafe-Kwakye
Sally Molloy

Faculty Mentor:
Melody Neely

Abstract:
Streptococcus agalactiae (Group B Streptococcus or GBS) is an opportunistic pathogen that is capable of colonizing the genitourinary tract of immunocompromised individuals, specifically

pregnant women and neonates. Women who test positive for GBS colonization during pregnancy are treated with heavy doses of antibiotics during delivery, often leading to disturbances in gut microbiota. Unfortunately, this treatment can have detrimental effects on immune system development and the metabolism of the child. GBS is the leading cause of neonatal meningitis worldwide, and as of now, we do not have a complete understanding of its disease-causing mechanisms, making it difficult to treat. In this project, the role GBS prophages play in bacterial fitness and virulence will be explored. Bacteriophage (phage) are viruses that infect bacteria and can insert their DNA into their host genome as a prophage. Prophages encode known virulence genes in many pathogens, but there is very little known about the prophages of GBS. GBS strain CNCTC 10/84 is a hypervirulent strain that carries one prophage in its genome. We cured CNCTC 10/84 of its prophage and will compare the virulence of the wild type to the prophage-cured strain using a zebrafish infectious disease model. Cell toxicity and viability assays, growth curve analysis, as well as hemolysis assays will be carried out to further determine whether the prophage is contributing to the virulence of CNCTC 10/84. Determination of how prophages contribute to the virulence of GBS can aid in identifying disease causing mechanisms and be useful in designing effective treatments.

1005. **The Role of Prophage McProf in M. chelonae Antibiotic Resistance**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Sarah McCallister, Undergraduate
Jaycee Cushman
Emma Freeman
Keith Hutchison
Sally Molloy

Faculty Mentor:
Sally Molloy

Abstract:
More individuals die worldwide from mycobacterial infections than any other infectious agent. In 2018, 11 million individuals worldwide were diagnosed with tuberculosis (TB) and there were 1.2 million TB-related deaths. With the emergence of multi-drug resistant strains of mycobacteria, including M. tuberculosis and M. abscessus, it's important to better understand mycobacterial antibiotic resistance in order to develop new treatments. Most bacterial pathogens carry prophage, an integrated viral genome within the bacterial genome, which are often linked

to virulence and antibiotic resistance. The role of prophage in mycobacterial virulence and antibiotic resistance is not understood. The goal of this project is to determine how a prophage, called McProf, impacts antibiotic resistance and gene expression of mycobacterial pathogen, M. chelonae, a close relative of M. abscessus. We have annotated the McProf genome and identified a prophage-encoded ESX toxin secretion system. These important and well described systems are known virulence systems in mycobacteria, including M. tuberculosis, but they have not yet been described in prophage. M. chelonae strains carrying McProf are more resistant to antibiotics clarithromycin and amikacin relative to strains lacking the prophage. To better understand how antibiotic resistance is altered in bacteria carrying prophage, RNAseq analysis will be performed on RNA isolated from M. chelonae with and without the McProf prophage.

1006. **Analysis of CYP2C19 and CFTR Genes for Personalized Medicine**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Madeline Kimble, Undergraduate
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Jack Burnell
Logan Christian

Faculty Mentor:
Denry Sato

Abstract:
General medicine is often imprecise and does not treat all patients effectively. Personalized medicine, however, provides a means of treating all patients specific to their genotype, allowing them to be treated more effectively. We analyzed mutations in the CYP2C19 and CFTR genes in PCR-amplified DNA from 15 anonymous saliva samples using gel electrophoresis and modified Sanger sequencing. Our data demonstrated the polymorphic M/V and V/V genotypes at amino acid 470 of CFTR are common, occurring in 66.66% and 33.33% respectively while no ΔF508 mutations were seen in our discernable data. In addition, the presence of CYP2C19 exon 5 heterozygous mutations occurred in 29% of conclusive samples while no mutations were seen in exon 4. Previous knowledge of minor allele frequencies for the M470V polymorphism and exon 5 mutation is 50% and 41%, respectively. In relation to our applicable findings, 100% of patients had at least one allele with the M470V mutation, and 29% of patients had at least one allele with the exon 5 mutation, demonstrating the commonality of the mutations. Our preliminary findings

highlight the importance of further implementing personalized medicine to improve treatment outcomes for patients with differing genetic backgrounds.

1007. **Mechanisms of the Hyperinflammatory Response to Influenza Infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
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Brandy Soos
Con Sullivan
Benjamin King

Faculty Mentor:
Benjamin King

Abstract:
Influenza A virus (IAV) is an enclosed, RNA virus that infects the respiratory system and is responsible for 21,000-41,000 deaths annually in America. Upon initial infection, the virus infects lung epithelial cells, resulting in an initial anti-viral inflammatory response by the innate immune system. As the infection continues, it elicits a long-term inflammatory response intended to reduce the severity of infection that can also result in tissue damage. Understanding how the innate immune system responds to IAV infection may lead to new influenza therapies. Neutrophils play an important role in the innate immune system, but little is known about how they function during IAV infection. The zebrafish is a recently established model to study IAV infection and offers unique advantages over other models because the function of neutrophils can be studied in vivo. We hypothesize that neutrophils have an important role in the response to IAV infection. To test this hypothesis we will examine the role of neutrophils during IAV infection by comparing responses from WHIM mutant (Tg1(- 8mpx:cxcr4b-EGFP)) zebrafish that lack functional neutrophils and sibling control zebrafish that have functional neutrophils. A preliminary survival analysis suggests WHIM mutants infected with IAV have a lower survival rate than controls infected with IAV. We will determine the level of infection and expression of candidate genes over a time course of infection. These studies will help us understand the genetic mechanisms that regulate the inflammatory response to IAV infection and the roles neutrophils have in that response.

1008. **Treatments for Secondary Dystroglycanopathies: NAD+ and Emergen-C Supplementation for DPM3 Mutants in Danio rerio**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
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Mary Astumian
Sarah Alrowaished

Faculty Mentor:
Clarissa Henry

Abstract:
Muscular dystrophies are a devastating group of genetic diseases that cause muscle wasting and weakness in patients. Secondary dystroglycanopathies are a class of muscular dystrophies caused by defects in the modification of essential muscle proteins. One gene important in modification encodes dolichyl-phosphate mannosyltransferase subunit 3 (DPM3). DPM3 mutations, and secondary dystroglycanopathies in general, are an understudied and mysterious group of diseases. They vary in expression and severity, but there is no cure. Current DPM3 treatments focus on the care of symptoms.This study aims to identify potential therapies for the rescue of muscle wasting at the molecular level. Genotyping of zebrafish stocks with HRMA, gel electrophoresis, and sequencing will expedite verification of carriers of the DPM3 mutation. Disease morphology and progression in mutant embryos will be examined by longitudinal birefringence experiments. Muscular structure will also be studied with fixing and staining of the embryos. Finally, to explore potential methods for disease muscle rescue, embryos will be supplemented with NAD+ and Emergen-C. Other models of secondary dystroglycanopathies studied in our lab have seen muscle health improvement with NAD+ and Emergen-C supplementation. Based on this research, we will work with a zebrafish model of DPM3-related secondary dystroglycanopathies and test the effectiveness of similar supplementation in rescuing the dystrophic muscle phenotype.

1009. **Defining the role of Beta-arrestin in ERK activation during JCPyV infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Sarah Nichols, Undergraduate
Colleen L. Mayberry
Melissa S. Maginnis

Faculty Mentor:
Melissa S. Maginnis

Abstract:
Human JC polyomavirus (JCPyV) infects up to 80% of the population and establishes a persistent, lifelong infection in the kidneys. In individuals with severe immunosuppression, JCPyV can spread from the kidneys to the central nervous system, resulting in the fatal demyelinating disease progressive multifocal leukoencephalopathy (PML), for which there are no effective treatments. JCPyV internalization is mediated by 5-hydroxytryptamine 2 receptors (5-HT2Rs) and clathrin-mediated endocytosis. Previous data gathered by the Maginnis laboratory details the importance of the 5-HT2R-related endocytic protein β-arrestin and activation of the mitogen activated protein kinase (MAPK) signaling cascade, specifically extracellular signal-regulated kinase (ERK), in facilitating JCPyV infection. Further, it is known that the MAPK adaptor protein, growth factor receptor-bound protein 2 (GRB2), is crucial for initiation of MAPK signaling. Specifically, GRB2 activates the MAPK protein Ras, followed by a series of phosphorylation events, and subsequent activation of ERK. Thus, as ERK is a critical regulator of JCPyV infectivity, and as ERK can be activated by GRB2, GRB2 may be necessary for ERK activation during JCPyV infection. Understanding how ERK is activated in cells challenged with JCPyV will enhance our understanding of viral pathogenesis. The goal of this project is to define whether activation of the 5-HT2Rs, β-arrestin, and GRB2 activate the ERK signaling cascade to drive viral infection in SVG-A cells. Preliminary data suggests no dependence on GRB2 for successful viral infection. Understanding how JCPyV hijacks host cell signaling to promote survival will fill critical gaps in knowledge that could provide a platform to develop antivirals.

1010. **Role of the Accessory Domain on CpsA Function and Capsule Production**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Gina DiFederico, Undergraduate

Faculty Mentor:
Melody Neely

Abstract:
Group B Streptococcus (GBS) can be found in the vaginal and genitourinary tract of females, as well as the genitourinary tract of males, where it behaves as a commensal organism. However, as an opportunistic pathogen, GBS has the capability to infect the immunocompromised, making it a major threat to neonates and fetuses. The pathogen can be passed from mother to baby either in utero or during birth. The capsule, which is a polysaccharide coating on the outside of the cell is considered the most important virulence factor in GBS. Expression of capsule plays a role in evasion of the host immune response to GBS infection. The presence of capsule on GBS depends on the CpsA protein, which is involved in the attachment of capsule to the cell wall. CpsA is a multi-functional protein containing an intracellular domain and two extracellular domains including the accessory and the LytR domains. Previous data demonstrates a small region within the accessory domain of CpsA that, when expressed separately, can have a negative effect on the amount of capsule on the cell. In this study, the deletion of the extracellular accessory domain of CpsA will help to determine the role of the domain on CpsA function and capsule production. Cell morphology analysis, capsule assays, and virulence studies will all be used to analyze results of a deletion of the accessory domain.

1011. **Mouse Telomerase Reverse Transcriptase as a Marker of Adult Stem Cells**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Josh Passarelli, Undergraduate
Gabriel Jensen
Kristy Townsend

Faculty Mentor:
Kristy Townsend

Abstract:
Improper energy balance and metabolism is associated with a variety of maladies and diseases, including diabetes and neuropathy. Adult stem cells (ASCs) are likely important for the adult brain to coordinate energy balance, in part by supporting the turnover of new neurons in the brain’s energy balance center, the hypothalamus. Currently, this field of stem cell research is greatly hindered by the lack of a specific and unique marker of ASCs in the brain. We

hypothesize that mouse telomerase reverse transcriptase (mTERT), which is important for persistent stem cell replication in other adult tissues, can be used as a specific and unique marker of quiescent ASCs. Here, we characterize mTERT+ cells and their progeny by performing co-staining experiments with tissues from mTERT-GFP direct reporter and lineage tracing mouse lines. mTERT+ cells in mTERT-GFP direct reporter mouse brains occasionally express known adult stem cell markers. These cells are found in well known stem cell niches and interestingly in niches where the potential for resident stem cells is less understood, such as the choroid plexus. Lineage-traced cells are widely dispersed throughout the brain and have been found to coexpress markers of mature cell types. Based on these results, we propose that mTERT+ adult stem cells residing within the adult mouse brain repopulate various regions of the brain with pericytes, epithelial cells, and other unknown mature cell types.

1012. **Characterization of Ncf1 Mutants in a Zebrafish Model of Innate Immune Function with Human Influenza A Virus Infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Lily Charpentier, Undergraduate
Brandy Soos
Benjamin King

Faculty Mentor:
Benjamin King

Abstract:
Seasonal influenza A virus (IAV) infections and their associated respiratory diseases are the cause of an estimated 650,000 deaths each year, according to the World Health Organization. The zebrafish is a powerful vertebrate model to study innate immune function and host-pathogen interactions as the function of neutrophils and other phagocytes can be characterized in vivo. Preliminary studies have shown an increase in neutrophil respiratory burst activity to eliminate the invading pathogen, yet little is known of all of the mechanisms involved in neutrophil function. The NADPH oxidase complex, of which neutrophil cytosolic factor 1 (Ncf1) is a key component, regulates reactive oxygen species (ROS) to control neutrophil response to viral infection. Although necessary to fight infection, this elicits a hyperinflammatory response that can damage the infected host epithelial tissue, leaving high-risk individuals with increased mortality rates. Our hypothesis is that a fully functional Ncf1 protein is required for neutrophil function, but morpholino knockdown of the gene will limit the amount of damaging ROS

hyperinflammation in host tissue. Our preliminary studies of system IAV infected embryos indicate that the survival of ncf1 morphants (MO) was increased compared to scrambled morphant control groups. We are currently conducting TCID50 assays to monitor viral titer over a span of 96 hours post-infection, and qRT-PCR studies to assay the expression of genes associated with neutrophil function in ncf1 and control MO. These studies aim to increase our understanding of neutrophil function that may eventually lead to new therapies for treating IAV infection.

1013. **The Development of a Senescence-Associated Biomarker Panel within Adipose Tissue**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Morganne Robinson, Undergraduate
Jake Willows
Magdalena Blaszkiewicz

Faculty Mentor:
Kristy Townsend

Abstract:
Cellular senescence is a process in which cells that have experienced extensive DNA damage or uncontrolled proliferation undergo a permanent growth arrest. Senescence is associated with aging and acts as a tumor suppressor by halting the unregulated growth of cells. However, it is hypothesized that the buildup of non-functional senescent cells can lead to age-related diseases. For example, age is a significant risk factor for developing peripheral neuropathy, a condition in which the distal nerves die back from superficial tissues, beginning with the denervation of skin and extending to the underlying subcutaneous adipose (fat) tissue. Adipose tissue performs multiple important immune, endocrine, and metabolic functions, and loss of neural innervation of the tissue can have adverse consequences. We hypothesize that age-related peripheral neuropathy of adipose could be due to accumulation of senescent cells; specifically myelinating Schwann cells. These glial cells support nerves by producing an insulating myelin coating that allows for faster neural transmission. Using RNA extracted from murine subcutaneous white adipose depots, qPCR analysis revealed a significant increase in the gene expression of the senescence marker IL-1α, with inconclusive results regarding other senescent markers. mRNA quantification has also shown nonsignificant increases in Schwann cell markers with age, including SOX10, as well as markers of synapses like PSD95, and vascular endothelial markers such as VEGFa, and CD31. Moving forward we plan to measure senescence-related gene

expression on FACS-sorted young and old Schwann cell populations from adipose, in order to further explore the mechanisms behind the development of age-related pathologies.

1014. **Microfluidic Systems for Droplet Generation in Aqueous Continuous Phases**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Rosamond Hickey, Undergraduate

Faculty Mentor:
Caitlin Howell

Abstract:
Microdroplet generators are a branch of microfluidic devices that offer promising breakthrough testing methods in a multitude of research fields by reducing testing volumes, cross contamination and supervision requirements while increasing repeatability and production rate. Droplet generators have the potential to produce uniform micro-droplets within the device at a rate that can be determined by the operator at a research or industrial scale, revolutionizing the way scientist perform laboratory tests. With the growing demand for microdroplet generators, it has become apparent that the materials to create the devices are expensive, not reusable, and are not ecological. Microdroplet generators created in a continuous casting process offer a potential alternative, this solution would make a more affordable, practical, sustainable, and portable device. However, it is difficult to create a device that sticks to a laminate surface with enough force to seal fluid into channels of the device. To test the viability of cast microdroplet generators, tests have been run to optimize the droplet formation under different flow regimes by comparing low/medium/fast flowrates under the same conditions while maintaining a seal between the laminate surface and the patterned release paper. Tests have been run using various carrier liquids, including mineral oils, silicon oils, and died water. The goal of the research is to demonstrate that microdroplet generation systems can be made more accessible and affordable when made using a continuous casting process.

Acknowledgements
This work is supported by the MSGC grant for undergraduate research

1015. **The Functional Role of Glia in Peripheral Metabolic Tissue**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Emma Paradie, Undergraduate
Magdalena Blaszkiewicz
Joshua Havelin

Faculty Mentor:
Kristy Townsend

Abstract:
Obesity and its comorbidities have reached pandemic levels, resulting in an increased prevalence of diabetes, which is often accompanied by peripheral neuropathy. While the brain is responsible for coordinating the balance between energy intake and energy expenditure, peripheral nerves are responsible for communicating between the brain and peripheral tissues, including adipose (fat) tissues. There are non-neuronal glial cells in the central and peripheral nervous systems (CNS, PNS, respectively) whose functions are vital for maintaining homeostasis, forming myelin, and providing support for nerves. Myelin is a fatty substance that wraps around nerves and acts similar to the insulation around a wire, allowing for saltatory conduction and increasing the speed at which electrical signals are sent through the nervous system. Demyelination of nerves leads to loss of proper nerve function and therefore contributes to neuropathy. While much remains to be discovered about cross-talk between glia and other cell types in the CNS, there is even less known regarding glia-nerve communication in the PNS. We have shown that a subset of peripheral nerves innervating adipose tissues are myelinated, and we can visualize what appear as specialized glia called Schwann cells, which regulate axonal myelination. Schwann cells are known to work with macrophages in lesioned peripheral nerves to clear myelin debris – vital for axonal regeneration. Schwann cells are also known to be able to switch between various phenotypes, but the functions and mechanisms of all of these Schwann cell subtypes have yet to be solidified, especially in adipose tissue. To date, we have optimized a unique protocol for immunopanning adipose tissue to isolate Schwann cells and other glial subtypes, which we are currently confirming with qPCR to assess cell type gene expression. Fluorescence-activated cell sorting of subcutaneous white adipose from young versus aged mice has revealed differing numbers of Schwann cell populations, coinciding with our previous findings of decreased innervation in adipose with aging.

1016. **Surface Contamination Detection Method Using Structural Color Analysis**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Oisin Biswas, Undergraduate

Faculty Mentor:
Caitlin Howell

Abstract:
Timely detection of surface contamination is critical to preventing the spread of infection and maintaining proper functioning of equipment. However, such detection can be challenging in environments where continuous monitoring is difficult, such as the International Space Station. Structural color, or bands of color that appear as different wavelengths of light reflect off a textured surface, has recently attracted attention as a method of visually indicating the state of a surface. Preliminary observations had shown that the appearance of specific bands of colors varied as a surface became contaminated. In this project, a repeatable fixed-angle lighting technique and setup was devised to replicate initial observations and explore them further. The initial approach with a commercial tilt-stage, light and camera allowed for visually observing structural color on the samples, however testing demonstrated that it did not produce images suitable for accurate computational analysis. A custom-made tilt stage was created to address this limitation. The new experimental rig additionally included an enclosed setup to aid in positioning of the sample, light, and camera, where images were taken of the samples at angles of 15, 30, and 45 degrees under exposure from LEDs of different colors. The results were subsequently analyzed to quantify any differences in color that were present between the clean and dirty samples at the various angles. This technique to quantify such differences has strong potential to further address the need of a low-cost, timely detection method of surface contamination in applications such as autonomous vehicles and public touchscreens.

1017. **Characterizing Epsins in Pheromone Gradient Tracking**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Sarah Latario, Undergraduate

Faculty Mentor:
Joshua Kelley

Abstract:
Endocytosis is the process by which cells take up extracellular components through the internalization of regions of the cell's plasma membrane. Epsins are proteins that aid in the control of this process by helping to curve the membrane during endocytosis. These proteins recruit and interact with other membrane proteins while binding the cytoskeleton, resulting in the membrane curving in the correct direction at the right time. This process is also used during cellular polarized growth such as the kind used by Saccharomyces cerevisiae during its response to pheromone. During this response, a G-protein coupled receptor (GPCR) recognizes the extracellular pheromone gradient and activates downstream signaling proteins that lead to polarized growth towards the high pheromone concentration. We suspect that epsins are involved in controlling this response by regulating downstream signaling molecules during endocytosis, resulting in the polarized growth observed in yeast responding to a pheromone gradient.They also may play a role in membrane localization of downstream proteins during this response. By deleting epsins, we hope to determine their exact role in the yeast's pheromone response pathway and if their activity may rescue defects during other steps in the pathway.

1018. **A Vascularized Medium for Passive Monitoring of Bacterial Growth**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Benjamin Chasse, Undergraduate

Faculty Mentor:
Dr. Caitlin Howell

Abstract:
Currently, infection in a person is often not detected until symptoms are present, or bacteria appear in their fluids. The purpose of this work is to develop a system which can detect the growth of bacteria in vivo in an early and non-invasive manner. To test this idea, a vascularized agar matrix was 3D printed to resemble the characteristics of a circulatory system. And, similar to how a circulatory system delivers nutrients and removes wastes from surrounding tissues, the 3D printed channels exchanged diffusible compounds with the surrounding matrix. The detection of signaling molecules from the surface was tested by 3D printing channels in LB agar, inoculating one system with wild type E. coli, and leaving the other without bacteria as a control.

Both systems were incubated at 37ºC for 24 hours. The channels of each were then injected with 1.0x PBS and were sampled and replaced four times over the following 58 hours. The samples were then analyzed using HPLC to assess differences between the diffused molecules in each. These results may be applied to help to create a detection system to help identify the presence of bacteria sooner and without the need for invasive techniques.

1019. **Investigating the Role of Serotonin Receptor Scaffolding Protein Calmodulin in JC Polyomavirus Entry and Infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
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Colleen L. Mayberry
Tristan M. Fong
Samuel T. Hess
Melissa S. Maginnis

Faculty Mentor:
Melissa S. Maginnis

Abstract:
JC polyomavirus (JCPyV) maintains a persistent kidney infection in 80% of the population. While renal JCPyV infections are asymptomatic, infections can progress to the central nervous system in immunocompromised individuals. At this stage, JCPyV infects glial cells and leads to progressive multifocal leukoencephalopathy, a fatal demyelinating disease for which there are no treatment options. This research aimed to determine the mechanisms by which JCPyV infects human kidney and glial cell types. JCPyV entry into both kidney and glial cells is mediated by serotonin 5-hydroxytryptamine (5-HT2) receptors, yet the mechanisms by which the receptors drive this process is poorly understood. Although it has been established that JCPyV uses 5-HT2Rs for internalization, direct interactions between these receptors and JCPyV has not been established. Using super-resolution microscopy, we have visually determined the localization and interactions between JCPyV and 5-HT2Rs. Additionally, 5-HT2R scaffolding protein, calmodulin (CaM) may have a role in JCPyV infection. CaM is an intracellular protein with many roles in cell activity, including endocytosis, a critical step in viral entry. To determine whether CaM plays a role in JCPyV infection, cells were treated with a CaM-specific inhibitor W7 and JCPyV infection was quantified by indirect immunofluorescence. This research will

better define how viruses utilize host-cell machinery to mediate infection. Outcomes of this research could serve as a foundation for the development of treatment strategies for JCPyV infection.

1020. **Impacts of ERK Activation on JC polyomavirus Infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Remi Geohegan, Undergraduate

Faculty Mentor:
Melissa S. Maginnis

Abstract:
JC polyomavirus (JCPyV) infects the majority of the population, causing an asymptomatic infection in the kidneys. In immunosuppressed individuals, JCPyV infects astrocytes and oligodendrocytes causing progressive multifocal leukoencephalopathy, a fatal disease. However, the mechanisms by which JCPyV regulates infection in astrocytes and oligodendrocytes is poorly understood. Current research is limited to in vitro cell culture models due to the specific tropism of JCPyV for the human host. The study of JCPyV in SVG-A cells, an immortalized human fetal glial cell line can be enhanced using a newly developed cell model, normal human astrocytes (NHAs), which provide a more accurate representation of infection in the host. Studies revealed that the progression of infection in NHAs differed from SVG-A cells, resulting in a delay in viral replication. JCPyV utilizes the mitogen activated protein kinase (MAPK) pathway leading to induction of extracellular-signal regulated kinase (ERK) phosphorylation, which is necessary for the progression of the infectious cycle. To determine whether the delay in infection in NHAs was due to differences in MAPK/ERK signaling, both cell lines were treated with an ERK activator and viral gene products T-Antigen (early transcription product) and viral protein 1 (VP1) (late transcription product) were quantified. Additionally, RNA sequencing analysis of MAPK/ERK signaling genes were evaluated using co-expression networks and ingenuity analysis. Our findings indicate that ERK phosphorylation may lead to increase the production of VP1, resulting in increased infection. These data enhance our understanding of viral regulation of gene networks and signaling pathways in the infectious cycle.

1021. **Genome Discovery and Annotation of a Novel Myoviridae Bacteriophage**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
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Marcus Ratz
Morgan Tittle
Jillian Corbett

Faculty Mentor:
Michael Wilczek

Abstract:
Bacteriophages are the most abundant organisms in the biosphere, totaling approximately 1031 virions on earth. Bacteriophages are viruses that infect bacteria. Most bacteriophage has yet to be studied and sequenced, and learning more about their genomes could teach us about phage biology as a whole. The bacteriophage studied are members of the family Caudovirales. Caudovirales are categorized into three morphotypes: siphoviridae (long, noncontractile tails), myoviridae (shorter, contractile tails) or podoviridae (short, noncontractile tails). The myoviridae RedWattleHog (RWH), a Cluster DX phage, isolated from Gordonia Terrae 3612 was sequenced and its DNA was analyzed using systems such as Glimmer, genemark, and Starterator. Evidence from each of the aforementioned programs was assembled in order to organize potential genes on the RWH genome, and to potentially determine their functions. RedWattleHog's genome is ~135,372 base pairs long. Its GC content is ~64.9%, which is close to the bacterial host, at 67.8%. There are ~215 genes predicted. Cluster DX contains only one other phage Stormageddon. With such a small cluster, many of the phams are small; some with only 2 phage. Studying RedWattleHog and other Bacteriophage genomes will unveil information about their hosts, bacteria, and allow for development in the field of microbiology and biomedical sciences as a whole.

1022. **Epsocamisio, the Little Gordonia Phage That Could (Without Integrase)**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Lauren Cusson, Undergraduate
Libbee Currie
Andre Dagle
Emma Dunn

Faculty Mentor:
Michael Wilczek

Abstract:
Bacteriophage are the most diverse and abundant organisms, with a total estimate of1031 in the biosphere. Despite the vast populous, current research has only made a small dent in the immense prospect of knowledge awaiting discovery. To address this, phage genomes were sequenced and by using bioinformatic programs the phage genomes were annotated to decipher the function of the genes. From this, comparisons were made to other known phages, aiding in the understanding of genetic mosaicism. One of the sequenced phages, Gordonia terrae phage Epsocamisio, was isolated from a soil sample using enriched isolation. This phage is a Siphoviridae and has a tail of ~150 nm and an icosahedral head of ~75 nm. It is a temperate phage that forms large circular plaques containing a clear center and a turbid halo. The presence of an immunity repressor in the genome is a potential support of this temperate lifestyle. Epsocamisio infects Gordonia westfalica, Gordonia rubripertincta, and Gordonia terrae. After sequencing, Epsocamisio was determined to be an A15 cluster phage with a genome length of 52,314 bp that comprise ~99 ORFs. Its GC content is 62.0% and its genome encodes for ~96 putative genes and ~3 tRNAs. Future study should be conducted on Epsocamisio to potentially find beneficial applications and to better understand A15 type phages.

1023. **Characterization of a novel Myoviridae bacteriophage in Gordonia terrae)**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Mykayla Weinstein, Undergraduate
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Colby Patton
Andreas Stephanou
Sam Weafer

Faculty Mentor:
Michael Wilczek

Abstract:
Bacteriophage (phage) are viruses that infect and kill bacteria for the proliferation of their genomes, and are the most abundant biological entities worldwide. These viruses have some of the oldest and most diverse genomes, and are of particular interest to research concerning antibiotic resistant bacteria. RedWattleHog is a phage that was isolated and characterized in Gordonia terrae. This bacterial host is an opportunistic pathogen in immunocompromised individuals; furthermore, characterization of G. terrae is difficult due to its rare genome. Thus, many phage genomes have not been sequenced using this bacterial host. Therefore, utilization of phage provides a better understanding of these complicated microorganisms as their lifecycle reflects the pathways utilized by their hosts. Further characterization of RedWattleHog has shown that it is a lytic Myoviridae phage. Phages of the Myoviridae family are rarely observed, appearing only in about 10% of the current phage population. Furthermore, our research has determined that RedWattleHog has a genome length of 135,372 base pairs (bp), a GC content of 64.9%, and it encodes for 214 open reading frames. Comparatively, the host genome has a length of 5.7 million bp, with a GC content of 67.8%. Additionally, the phage genome is circularly permuted, containing no cos sites. With the use of bioinformatics and additional extensive research, we can continue the analysis of the RedWattleHog genome as well as other phages in its cluster and its family to get a greater understanding of this emerging opportunistic pathogen, Gordonia terrae.

1024. **Characterization of Bacteriophage BBQValindra**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Desiree Tanner, Undergraduate
Alison Dewsnap
Hannah Maurais
Stephen Rezack

Faculty Mentor:
Melody Neely

Abstract:
Bacteriophages, viruses that infect bacteria, are the most abundant biological entities in the biosphere, with a highly genetically diverse population consisting of approximately 1031 particles. Studying these entities allows researchers to elucidate phage diversity and evolution, and gain insights into the physiology and virulence of their bacterial host. Despite the high genetic diversity of bacterial host Gordonia, currently only 454 Gordonia phages have been sequenced. In order to overcome this gap in knowledge, novel Gordonia phage, BBQValindra, was isolated and its genome was sequenced by Illumina sequencing, assigned to cluster DB, and annotated using bioinformatics tools such as DNA Master, PECAAN, Phamerator, NCBI, and Phagesdb. BBQValindra has a genome length of 46,875 bp, has 67 putative genes, and a GC content of 67.3% compared to Gordonia's GC content of 67.8%. Similar to other phage in cluster DB, BBQValindra has a temperate lifestyle and Siphoviridae particle morphology. BBQValindra shares an extensive amount of synteny with cluster DB phages HannahD, GEazy, Bowser, and Eyes, however, it also exhibits a region of gene mosaicism with CZ phages. Upon the completion of gene mapping BBQValindra, the unsolved mysteries of the emerging phagosphere will be further unraveled, aiding in advancements in the field of study as a whole.

1025. **Bring Your Own tRNA**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Noah Burby, Undergraduate
Audrie French
Logan Christian
Daisy Drinkert
Katie Southworth
Claire Nowak

Faculty Mentor:
Melody Neely

Abstract:
Bacteriophage (phage) are viruses that infect a range of bacterial hosts and are one of the most diverse biological entities in the biosphere with an estimated population of 10^{31} particles. Phage are mostly uncharacterized, and with more knowledge, huge strides could reveal breakthroughs in evolution, medical research, and information about their bacterial hosts. NiceHouse is a novel Rhodococcus erythropolis phage isolated near a residence hall at the University of Maine,

Orono, Maine via direct plating. Characterization included electron microscopy, plaque morphology, restriction endonuclease digests, and immunity assays. ; Following isolation, the genome was sequenced and annotated through the use of genome and bioinformatic databases. NiceHouse is a Siphoviridae cluster CE phage with only one other member, Trina. It has a genome length of 142,586-bp and a GC content of 44.9%, which is a stark contrast to its host's GC content of 62.5%. The genome contains 250 ORFs, 80+ of which are orphams, at least 27 tRNAs, and direct terminal repeated ends. NiceHouse is a highly unique phage that may be able to infect a wide range of hosts. Future research should include host range assays and superinfection immunity tests to determine the relatedness to other phage and hosts.

1026. **Understanding Moosehead: Member of the Unknown Cluster CZ6**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Isaac Lambrecht, Undergraduate
Jacquelyn Cook

Faculty Mentor:
Melody Neely

Abstract:
Bacteriophage (phage) are viruses that infect bacterial hosts and are the most abundant biological entities on the planet with a predicted 1031 particles. Bacteriophage that specifically infect the host Gordonia terrae are especially diverse and little is known about why these phage are so different. Novel Gordonia bacteriophage Moosehead was isolated from a soil sample using direct plating and was visualized using electron microscopy revealing Siphoviridae morphology. Moosehead belongs to cluster CZ, and one of only two phage in subcluster, CZ6. The Moosehead genome was isolated, sequenced, and compared to other phage in the Phagesdb database to find bacteriophage in the same cluster and subcluster. Moosehead has a GC content of 65.1%, a genome length of 42,671 base pairs with 77 open reading frames, 14 of which are genes without a known function. To provide better understanding of the function of the unknown genes of Moosehead, there needs to be more research into subcluster CZ6 bacteriophage.

1027. **What is Upyo? Isolation and Annotation of Gordonia Phage Upyo.**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Patrick Fleming, Undergraduate
Grace LaFrance
Mykaela Blackerby
Haley Foreman
Brendan Moline
Patrick Fleming

Faculty Mentor:
Melody Neely

Abstract:
Isolation and Annotation of Gordonia Phage Upyo
Bacteriophage are viruses that infect bacterial hosts and are the most numerous biological entity on the planet, having an estimated population of 1031 particles. There is a significant gap in our knowledge of bacteriophage, as there are less than 3400 total phage sequenced to date. Novel bacteriophage Upyo was isolated from a soil sample using a direct isolation technique, cultured in a Gordonia terrae host, and sequenced by Illumina sequencing. Upyo is classified as a lytic, cluster CD phage that exhibits Siphoviridae particle morphology. The genome of Upyo has a GC content of 68%, encodes no tRNAs, and consists of 45,732 nucleotides that translate into 72 putative proteins, many of which have functions that are unknown. Further research can help determine the functions of the unknown proteins called by the genes, which will continue to deepen the scientific understanding of bacteriophage and their impact on the world.

1028. **Examining Telomerase as a Marker of Neurogenesis to Further Understand Feeding Behavior and Energy Regulation**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Olivia Stevenson, Undergraduate
Gabriel Jensen
Kristy Townsend

Faculty Mentor:
Kristy Townsend

Abstract:
The obesity epidemic has succeeded in virtually tripling in the last thirty years leaving millions of individuals at an increased risk of detrimental diseases such as high blood pressure and type two diabetes. We understand that the energy regulating center of the brain, the hypothalamus, becomes dysregulated when poor eating habits are developed and maintained. These poor eating habits in turn interrupt the brain's ability to send and receive signals regarding specific energy requirements, which may lead to obesity and disease. This dysregulation has been linked to changes in neurogenesis, or the production of newborn neurons. However, the field lacks a definitive marker of adult stem cells, inhibiting further understanding regarding their role in producing newborn neurons in the hypothalamus. Research has demonstrated energy balance-associated hypothalamic neurogenesis and proliferation, although the location and identity of the cells involved in these processes remain unclear. Tanycytes are specialized, glia-like cells subjected specifically to the hypothalamus, strategically positioned in a manner that allows communication with the CFS, median eminence, and hypothalamic nuclei. A subset of tanycytes is understood to bear features demonstrated in adult stem cells (ASCs), including their ability to proliferate. To study tanycytes, we are utilizing transgenic mice that identify a potential population of quiescent adult stem cells in the mouse brain. Telomerase reverse transcriptase, or TERT, is the enzymatic component of telomerase, a ribonucleoprotein complex that maintains chromosomal telomere length. TERT is utilized as a stem cell marker in various adult tissues, but has not yet been studied in the brain. By utilizing a transgenic, lineage tracing mouse line, we are permitted to locate mTERT+ cells via a doxycycline-controlled inducible CRE. As it's thought TERT may be utilized as a novel ASC marker, it was hypothesized that there would be increased mTERT-positive cells in the brain's neurogenesis niches, most notably within the hypothalamus. It was additionally hypothesized that tanycytes, as well as markers of neurogenesis, would be co-localized with cells expressing TERT. We present evidence here of the expression of TERT+ cells within the ventricular niches of the brain, including the hypothalamus, which may reveal populations of hypothalamic ASCs.

1029. **Antioxidant Effects of Winterberry Leaf Extract**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Brendan Moline, Undergraduate
Cara McKinnon

Sam Caito
Weaam Al Hallaf
Brian Perkins
Jennifer Newell-Caito

Faculty Mentor:
Jennifer Newell-Caito

Abstract:
The holly plant genus Ilex contains 15 species native to North America. Native American tribes in the Northeast have historically used Ilex verticillata or winterberry leaves as a medicinal tea. For that reason, it was hypothesized that these winterberry leaves may have antioxidant properties. Polyphenols are secondary metabolites in plants which have been recently explored as antioxidants. Epidemiological studies have shown that long-term consumption of diets rich in plant polyphenols offer protection against development of cancers, cardiovascular diseases, diabetes, osteoporosis, and neurodegenerative disease. A polyphenolic extract was created by drying and distilling the winterberry leaves and the total phenolic content (TPC) was determined to be 524.45 ± 1.82 μg gallic/mL of extract. Using C. elegans as an in vivo model organism, a survival curve using the extract yielded an LD50 of 5.87%. Using this data, worms were pre-treated with 1/10%, 1%, and 5% extract and then the known oxidants manganese(II) chloride ($MnCl_2$) and jugulone. The antioxidant effect of the extract was examined by measuring total reactive oxygen species (ROS). In the presence of the extract, there was a two-fold dose-dependent decrease in the total ROS generated with $MnCl_2$, and a significant reduction in total ROS generated in the jugulone treatments. These are the first results suggest that the polyphenolic compounds in winterberry leaves act as antioxidants in vivo.

1030. **Low-Dose Arsenic Exposure Impacts the Expression of Orthologous Breast Cancer Associated Genes in Zebrafish Embryos**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Ezekiel Robinson, Undergraduate
Matthew Cox
Tamra Benson
Basel White
Lillie Fortier
Keith Hutchison

Benjamin L. King

Faculty Mentor:
Benjamin L King

Abstract:
In 2017, a United States Geological Survey model estimated 2.1 million US residents drink well water with arsenic levels above the 10ppb EPA maximum. Arsenic consumption has been shown to cause health and developmental problems including lower IQ and multiple types of cancer. Accelerated research into arsenic's developmental effects could change legislation to protect human health. The aim of this experiment was to identify differentially expressed zebrafish orthologs of human breast cancer genes during arsenic exposure. We analyzed RNAseq data of 54, 60, and 66 hours post-fertilization embryos exposed to 0, 2 and 10 ppb arsenic. We hypothesized zebrafish orthologs of human breast cancer associated genes would be differentially expressed during arsenic exposure. Of the 94 found, mmp13a, mmp9, and fosab were significantly dysregulated at both 2 ppb and 10 ppb arsenic exposure at all three timepoints. In humans, FOS is a proto oncogene and MMP13 and MMP9 are growth related genes associated with breast cancer through angiogenesis and metastasis. Our data suggest that arsenic exposure could lead to increased risk of breast cancer. Additional studies in zebrafish and mouse models need to be conducted to investigate the role of low-dose arsenic exposure and cancer.

1031. **In vivo Imaging of the Respiratory Burst Response to Influenza A Virus Infection.**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
James Seuch, Undergraduate
Brandy-Lee Soos
Con Sullivan
Benjamin King

Faculty Mentor:
Benjamin King

Abstract:
The CDC estimated that seasonal influenza A virus (IAV) infections resulted in 490,600 hospitalizations and 34,200 deaths in the US in the 2018-19 season. The long-term goal of our research is to understand how to improve innate immune responses to IAV. During IAV

infection, neutrophils and macrophages initiate a respiratory burst response where reactive oxygen species (ROS) are generated to destroy the pathogen and recruit additional immune cells. While ROS molecules, such as hydrogen peroxide (H2O2), help clear the virus, the signaling cascade can also lead to excess neutrophil recruitment, hyperinflammation, and tissue damage. We are developing a Danio rerio transgenic fluorescent reporter line to study neutrophil function and H2O2 concentration during IAV infection in vivo. Using Tol2 transgenesis, we are developing this line to express the hydrogen peroxide biosensor protein, HyPer, in neutrophils. HyPer fluoresces at different wavelengths dependent on the concentration of hydrogen peroxide. We have designed the genetic construct to drive the expression of HyPer using the myeloid peroxidase (mpx) promoter expressed in neutrophils . Once developed, we plan to cross the line, named Tg(mpx:HyPer), to the neutrophil reporter line, Tg(mpx:GFP), to visualize how neutrophils generate ROS in response to localized IAV infection. The Tg(mpx:HyPer);Tg(mpx:GFP) line may also be used to study neutrophil function and ROS in bacterial, fungal and other viral infections.

1032. **Receptor Protein IL-23 is Crucial in Innate Immunity and Activation of Th17 Cells in Candida albicans Infection**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Brian Elsemore, Undergraduate

Faculty Mentor:
Robert Wheeler

Abstract:
Candida albicans is an opportunistic fungal pathogen found in the normal flora of healthy humans. C. albicans contributes a significant amount of nosocomial infections every year. The innate immune system is a first line defense in foreign invasion in vertebrates. Several molecular mechanisms are utilized by the innate immune system to identify the invader and mark it for destruction by the organism’s white blood cells. Zebrafish are used as a model organism for the study of C. albicans due to the vast benefits they offer such as real-time observation of the infection. Literature suggests IL-23 is a receptor responsible for activation and recruitment of bone-derived immune cells such as Th17 cells. CRISPR is a genome editing tool that was utilized to remove a target sequence in the gene and can be taken advantage of to effectively remove an entire gene. Breeding these mutant fish will result in a homozygous fish for the mutation, using zebrafish expressing fluorescent immune cells the recruitment and viability of

the immune cells can be monitored in real time. Using IL-2R mutant fish expressing fluorescent immune cells in C. albicans infection, the role of IL-23R can be observed an analyzed to draw conclusions on its role in innate immune response.

1033. **The impact of BPs lytic infection on pathogenic Mycobacterium chelonae and viral gene expression profiles**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Colin Welch, Undergraduate
Matt Cox
Maddie Kimble

Faculty Mentor:
Sally Molloy

Abstract:
Pathogenic mycobacteria, such as Mycobacterium tuberculosis, are the leading cause of death by infectious agents worldwide (WHO, 2019). Our research aims to identify the mechanisms of mycobacterial virulence in order to develop novel treatments for mycobacterial disease. A majority of bacterial pathogens carry prophage, an integrated bacteriophage genome within the host genome, and they often alter bacterial virulence, including antibiotic resistance (Broussard G., et al, 2013; Brüssow H, et al., 2004). The prophage BPs drastically increases expression of antibiotic resistance gene whiB7 in the pathogen M. chelonae. However, it is unclear which mode of infection within a culture of lysogens alters gene expression within the bacterial host. In a population of lysogens, infected bacteria carrying prophage, there is a subset of cells where the prophage is induced into a lytic infection. This results in phage replication, production of viral progeny, and lysis of the host cell. To determine if this subset of lytically-infected cells is responsible for changes in whiB7 expression, we must characterize both bacteriophage BPs and M. chelonae gene expression during a strictly lytic infection of M. chelonae. To determine gene expression profiles of both virus and bacteria, RNA was isolated at various times from M. chelonae cells after mock or BPs lytic infection. The BPs genes expressed at varying phases of lytic infection will be determined by mapping RNAseq reads to the BPs genome. whiB7 expression in BPs-infected M. chelonae relative to uninfected cells was determined by qRT-PCR. whiB7 is not upregulated during strictly lytic BPs infection.

1034. **Antimicrobial Cetylpyridinium Chloride Inhibits Immune Mast Cell Function**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Christian Potts, Undergraduate
Bright Obeng
Bailey West
Suraj Sangroula
Marissa Kinney

Faculty Mentor:
Julie Gosse

Abstract:
Cetylpyridinium chloride (CPC) is used as an antimicrobial agent in many popular mouthwashes, at 1500-3000μM levels, and other consumer products. Little is known about the toxicology of CPC on eukaryotes, and such widespread exposure of CPC calls for investigation for more information. Mast cells, found ubiquitously throughout the human body, play a key role in the immune system, physiological processes, and diseases. The Gosse lab has demonstrated that CPC inhibits mast cell degranulation (the release of bioactive substances such as histamine and serotonin) at CPC concentrations as low as 1μM, roughly 1000 times lower than the concentration found in consumer products. We are investigating the molecular mechanisms of this inhibition. Through use of the genetically-encoded voltage indicator ArcLight A242, we demonstrated that CPC does not interfere with
the plasma membrane potential of the cells. We have investigated the effect of CPC on antigen stimulated Ca2+ influx into the cytosol through CRAC channels using the genetically encoded calcium indicator pGP-CMV-GCaMP6f. We found that CPC exposure is decreasing cytosolic Ca2+ levels by 40.4% on average with a 0.005μg/mL antigen dose. Another effect that will be studied is the inhibition of ER Ca2+ release into the cytoplasm through ER Ca2+ GCaMP constructs. This research will provide knowledge on the effects that CPC is exhibiting on eukaryotic cell signaling, allowing the prediction of CPC effects on other eukaryotic cell types that share similar signaling pathways. Continuing this research will provide a better understanding of the overall effect of CPC on human and wildlife health.

1035. **Investigating the Potential Relationship Between Black Soldier Fly Larvae Reared on Potato Scrap Substrate and the Suppression of Gram-Positive Bacteria**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Marissa Kinney, Undergraduate

Faculty Mentor:
Edward Bernard

Abstract:
The black soldier fly larvae (Hermetia illucens) are becoming a popular, sustainable choice of feed additive for both agriculture and aquaculture. Black soldier fly larvae (BSFL) are favored because their composition can be tailored to fit the needs of the consumer. BSFL digest organic waste, developing on food scraps and manure. Previous studies have shown that BSFL suppress pathogenic bacteria. There is evidence of suppression of Gram-negative bacteria, but a lack of evidence for suppression of Gram-positive bacteria. In the Bernard lab, we worked with black soldier fly larvae reared on potato substrate to test for potential suppression of methicillin-resistant Staphylococcus aureus. We conducted two rounds of a week-long experiment, taking samples for analysis at days 0, 3, and 7. The samples were plated on a general agar (TSA) and Staphylococcus selective agar to determine if suppression of MRSA could be seen throughout the 7 days. Colony counts were determined and will be analyzed using various statistical methods. We also tested if the soluble portion of the BSFL riddled substrate (either inoculated with MRSA and not) had any suppression on the growth of MRSA. This data will also undergo statistical analysis.

1036. **CPAP-Compliance of Aging Individuals with Obstructive Sleep Apnea With or Without Mild Cognitive Impairment**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Bailey Carter, Undergraduate

Faculty Mentor:
Marie Hayes

Abstract:
With over 20 million Americans affected by obstructive sleep apnea (OSA), and over 30% of sleep apneic patients are not compliant with the most common form of treatment, CPAP (Continuous Positive Airway Pressure). The proposed study looks to investigate the relationship between OSA, CPAP-compliance, and cognitive decline associated with many aging-related neurodegenerative diseases. Our group has performed in-home sleep studies using a patented, sensor mattress-sheet device compared to standard actigraphy. Demographics including a questionnaire on OSA compliance during sleep and neurocognitive tests were administered to participants between 60 and 90 years of age and cognitive decline meeting criteria for MCI (Mild Cognitive Impairment, the prodrome of Alzheimer's Disease) was determined. CPAP compliance in relationship to MCI diagnosis was examined. It hypothesized that there will be a correlation between CPAP-compliance of OSA participants and increased cognitive functioning, compared to the non-CPAP-complaint counterparts. Our preliminary results indicate that there are significant correlations (0.230 - 0.431) between OSA diagnosis and male sex, and increased risk for depression, diabetes, and obesity. Preliminary findings also indicate that CPAP compliance (daily use) shows improved health indicators and outcomes. No association with MCI was found. Neurocognitive status, OSA and compliance will be examined for subtest deficits in performance.

1037. **Investigating the Interaction of Streptococcus Agalactiae and Candida Albicans in vivo and in vitro**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Kathryn Patenaude, Graduate
Siham Hattab
Dr. Robert T. Wheeler
Dr. Melody Neely

Faculty Mentor:
Melody Neely

Abstract:
Treating opportunistic infections can be problematic because we don't have a complete understanding of the role other organisms found in the localized environment have on the progression of infection. Both the fungus Candida albicans (C.a.) and the bacteria Streptococcus agalactiae (Group B Strep or GBS) are commensals that reside in the vaginal tract, and both can

cause opportunistic infections, which often progress to co-infections. What we don't understand is how interactions between these organisms affects progression of disease or treatment outcomes. Previous in vitro work has sought to analyze synergistic and antagonistic interactions between other commensal bacteria and C.a., but there is not much known about how GBS and Ca interact in co-infections and its influence on treatment effectiveness. Through both in vitro and in vivo experimental methods, we will investigate the influence each have on each other in their individual growth, their virulence, and their resistance to treatment. Zebrafish are an effective model for studying in vivo interactions between these two commensals as they have highly conserved immune factors with humans, can be genetically manipulated, and are transparent as larvae, making it possible to image and track the progression of infection in real-time. By using both in vitro and in vivo experimental methods we will gain a better understanding on how GBS and Ca interact in a host and their influence on treatment effectiveness.

1038. **Delayed healing and Nav1.8 nerve regeneration following corneal injury in Sox11 conditional knock-out animals**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Cara Sullivan, Graduate
Jun Lee
Ian Meng

Faculty Mentor:
Ian Meng

Abstract:
Corneal nerve injuries are a common source of ocular pain and discomfort that can result from disease, injury and ocular surgeries. Delayed healing of the corneal epithelium and nerves can lead to extended pain and discomfort. This study investigated the role of the nerve regeneration-associated gene Sox11 in corneal wound healing and reinnervation following acute and chronic injury. Two injury models were used to create corneal nerve injury, double lacrimal gland excision (LGE) which induces chronic dry eye by eliminating the aqueous component of tears and corneal abrasion (CA) which mechanically removes the corneal epithelium and axon terminals. LGE results in persistent corneal epithelial cell damage and retraction of corneal afferent nerve terminals, while the abraded axon terminals in CA are allowed to recover. Corneal fluorescein was used to examine the severity of epithelial damage, mechanical sensitivity was

evaluated using a corneal aesthesiometer and nerve terminal density was imaged and Sholl analysis was performed. This study found that Sox11 knockout animals exhibited delayed epithelial healing following both acute and chronic injury. Post-injury mechanical hyposensitivity was observed across phenotypes and nerve regeneration was significantly reduced in Sox11 knockout animals. Expression of key regeneration factors, while normally shown to increase following corneal injury, was diminished following injury where Sox11 expression was knocked down. In summary, our results provide evidence of Sox11's intrinsic role in nerve development and the impact of its absence on nerve regeneration and epithelial healing.

1039. **AAV9-Ighmbp2 Gene Therapy Significantly Improves Motor Performance in Severe SMARD1-like Mouse Model, nmdem3**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Sarah Holbrook, Graduate
Greg Cox

Faculty Mentor:
Greg Cox

Abstract:
Autosomal recessive mutations in IGHMBP2, a ubiquitously expressed DNA/RNA helicase, have been linked to childhood neuromuscular degenerative diseases (NMDs). C57BL/6J-Ighmbp2em3Cx is a SMARD1-like strain, or Spinal Muscular Atrophy with Respiratory Distress, created via CRISPR-Cas9 targeting of the IGHMBP2 gene and hereafter referred to as em3. SMARD1 is characterized by muscle weakness starting in the distal extremities and diaphragmatic paralysis leading to respiratory failure. Most patients are diagnosed in early infancy and die in early childhood. The em3 mouse has more severe muscle atrophy than the historical SMARD1-like model (nmd2J) in the hind limb, diaphragm, and intercostal muscles. The em3 mouse model also has an average lifespan of ~3 weeks compared to the 2J's ~3 month lifespan.
Gene therapy has shown promise in another NMD, Spinal Muscular Atrophy (SMA). In collaboration with the Meyer lab at Nationwide Children's Hospital in Columbus, OH, we are testing 2 different AAV9-Ighmbp2 vectors. Each has a different promoter with one having a Chicken β-Actin (CBA) Promoter [higher expression levels than endogenous levels] and the other having a truncated Methyl-CpG binding protein 2 (MECP2 aka P546) promoter

[expression levels close to endogenous levels expressed by muscles and neurons]. We found that both viruses mitigated the nmd phenotype with varying success.

1040. **Injury-Induced Nociceptive Sensitization and Recovery in Drosophila**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Christine Hale, Graduate
Ramaz Geguchadze
Samia Pratt
Julie Moulton
Courtney Brann
Geoffrey Ganter

Faculty Mentor:
Geoffrey Ganter

Abstract:
Nociceptive sensitization underlies and perpetuates chronic pain, a condition that affects ~50 million adults nationwide. With many treatment options for chronic pain, such as opioid analgesics, carrying numerous deleterious side effects, research into safer and more effective treatment options is crucial. Recently, an injury-induced nociceptive sensitization model was developed using the larvae of the fruit fly, Drosophila melanogaster, in which UV-injured animals become hypersensitive. Using this model, the necessity and sufficiency of a novel pathway, the Bone Morphogenetic Protein (BMP) pathway, functioning in the nociceptors, was revealed. At present, we propose to build upon this knowledge and reveal a more complete mechanism for how nociceptive sensitization occurs by investigating into the potential roles of other novel genes/signaling pathways. In addition to our focus on mechanisms that promote hypersensitivity, we also propose to expand our efforts by bringing new focus to the resolution phase of the nociceptor as its hypersensitivity subsides. To facilitate these efforts, because the larval stages of fruit fly development are relatively brief, we are also developing a methodology that allows longer term experimentation of nociceptive sensitization after injury in adult fruit flies. Recent efforts toward this goal include mapping the adult fruit fly nociceptor distribution by confocal microscopy and developing thermonociception methods for use with adult flies. Our ultimate aim is to better understand the mechanisms of nociceptive sensitization so that better treatment options for chronic pain may be revealed.

1041. **Role of Non-Coding RNAs in Adaptation to Environmental Stressors Through the Study of Natural Populations**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Kayla Barton, Graduate
Adrienne Kovach
Brian Olsen
Benjamin King

Faculty Mentor:
Benjamin King

Abstract:
The long-term goal of our research is to understand the genomic architecture of 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 environment relative to inland species. We are studying three tidal marsh and three inland sparrow species 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. This will be done by opportunistically sampling sparrow chicks, extracting RNA, sequencing small RNA, and annotating miRNAs and comparing miRNA between species. To our knowledge, this would be the first study to examine the evolution of miRNAs among these species.

1042. **Characterizing the Impact of Phage Gene Products on Host Fitness and Virulence in Non-Tuberculous Pathogenic Mycobacteria**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Jaycee Cushman, Graduate
Emma Freeman
Sarah McCallister
Keith Hutchison
Sally Molloy

Faculty Mentor:
Sally Molloy

Abstract:
Mycobacterium tuberculosis is the leading cause of mortality among infectious agents, responsible for 1.2 million deaths in 2018 (1). Emergence of multi-drug resistant strains has hindered effective treatment (2). Increasing our understanding of mycobacterial virulence is important for the development of more effective treatments. Integrated bacteriophage genomes, prophage, are hypothesized to contribute to mycobacterial fitness and virulence. How prophage impact bacterial virulence, particularly when they don't encode an obvious virulence factor, is not understood. We are investigating the role of prophage in mycobacterial virulence in non-tuberculous M. chelonae. RNAseq analysis of M. chelonae carrying prophage BPs showed drastic changes in bacterial gene expression, including conserved virulence gene, whiB7, and a padR-like gene, both of which are known transcriptional regulators of antibiotic resistance genes. We constructed recombinant strains of M. chelonae to overexpress lysogenic BPs genes gp5 and gp33. RT-qPCR analysis of these strains demonstrated no significant impact on whiB7 or padR expression. Altered expression of padR and whiB7 may be caused by an interaction between BPs and a second prophage in the M. chelonae genome, McProf. If true, changes in gene expression would only be detected in strains carrying both prophage. padR and whiB7 expression levels were compared by qRT-PCR analysis of RNA from M. chelonae strains carrying both prophage, BPs only, McPRof only, and no prophage. whiB7 induction only occurs in the presence of both prophage. BPs alone does not impact padR expression; however, McProf reduces padR expression and the presence of both phage synergistically reduces padR expression.

1043. **JC Polyomavirus Infectivity is Reduced by Inhibition of Calcium Signaling Pathways**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Avery Bond, Graduate
Mason Crocker

Faculty Mentor:
Melissa Maginnis

Abstract:
JC polyomavirus (JCPyV) is the causative agent of a deadly demyelinating disease known as progressive multifocal leukoencephalopathy (PML). While many people do not know of this virus, it asymptomatically affects upwards of 80% of the population. However, in immunocompromised individuals, JCPyV leads to PML and typically death within one year of PML onset. There are currently no effective treatments for PML, and understanding specifics of the JCPyV infectious cycle will help to identify possible drug targets. Recently, the Maginnis laboratory performed a large-scale drug screen using the National Institutes of Health (NIH) Clinical Collection and assayed viral infectivity using high-throughput In-cell Western techniques. Results from the screen showed that multiple FDA-approved drugs that target calcium signaling pathways were found to reduce JCPyV infection. Additionally, other studies in the Maginnis lab have demonstrated the importance of the calcium/calmodulin pathway during JCPyV infection. To uncover the mechanism of JCPyV infection inhibition, calcium pathway inhibitors will be further examined by treating cells with inhibitors and siRNAs to modify constituents of the pathway and measure infectivity. Overall, our results demonstrate that calcium plays a role in the JCPyV infectious lifecycle. These findings further our understanding of cellular pathways utilized during JCPyV infection and illuminate potential targets for the design of antiviral therapies.

1044. **Biointerface of Cellulose Nanofibril Material for Application as Botanical Wound Dressing**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Marissa McGilvrey, Graduate

Faculty Mentor:
Caitlin Howell

Abstract:
Cellulose nanofibril (CNF) material has potential for use in a wide variety of biomedical applications including drug delivery, tissue regeneration and wound dressings. Inherent properties of CNF such as high surface area, breathability, chirality, light weight and ability to form hydrogen bonds across cellulose chains or other polymeric matrices contribute to the

engineering capacity of CNF. However, there are some characteristics of CNF that are not fully understood such as antimicrobial or anti-fouling. The goal of this project is to study how surface texture and hydration effect pulp and CNF film interface with biofluids and associated protein adhesion which is known to initiate microbial growth. Surface tension of water and blood droplets was measured by finding the angle in which droplet contacts the pulp or CNF film, using ImageJ Droplet Analysis. The effect of hydration on film protein adhesion was observed visually following application of water or blood droplets. Surface texture and hydration level were found to influence droplet surface tension and level of blood protein adhesion. High heat sterilization of CNF was found to further increase droplet surface tension compared to pulp and unsterilized CNF, which creates potential for greater utility in clinical applications. The physical properties of CNF make it a valuable material to create botanical-based wound dressings in which both surface texture and hydration can be modified for a wide range of wound types, from burns to purulent infections. As a renewable resource in Maine, wood-based wound dressings have ability to expand use of this natural resource.

1045. **Cellulose nanofiber/ Hydroxyapatite nanocomposites characterization for hard tissue replacement application**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Sahar Roozbahani, Graduate
Jacob Halbrook

Faculty Mentor:
Michael Mason

Abstract:
Considering biocompatibility of cellulose nanofiber and its structural similarity to the collagen, adding hydroxyapatite as a mineral can resemble hard tissue structures such as teeth, nail and bone which makes this composite a promising material for hard tissue replacement applications. Cellulose nanofiber/Hydroxyapatite nanocomposites were prepared by mixing different ratios of Cellulose to Hydroxyapatite. In this study, we made three different thicknesses of films, each having the ratio between 0 to 40% of hydroxyapatite. The nanosized biologically relevant hydroxyapatite used in this research was prepared by a hydrothermal method and it was mixed with cellulose nanofiber solution in a shaker. Films were tested for their mechanical properties. We measured tensile strength and modulus of elasticity of the films using an Instron machine and results indicated that thin films with 25% of hydroxyapatite showed higher normalized

tensile strength compared to the thick films with the same percentage. Generally, thinner films showed to have higher normalized tensile strength compared to thick samples.

1046. Muscle Fiber Transmembrane Protein Localization in a Zebrafish Dystroglycanopathy Model

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Mary Astumian, Graduate
Prakash Raut
Clarissa Henry
Sam Hess

Faculty Mentor:
Clarissa Henry

Abstract:
Muscular Dystroglycanopathies are progressive diseases, with varying severity, affecting neurological and muscle health. In functional muscle fibers, the transmembrane proteins alpha-dystroglycan and integrin-alpha7, link the inside actin cytoskeleton to proteins in the outside extracellular matrix (ECM). To function properly, integrins need to cluster in the muscle cell membrane and alpha-dystroglycan needs to be glycosylated. The GMPPB gene is essential for this proper glycosylation. GMPPB encodes GDP-mannose pyrophosphorylase which synthesizes GDP-mannose, a precursor for the glycans that glycosylate alpha-dystroglycan. GMPPB is mutated in subtypes of dystroglycanopathies.
Dystroglycan and integrin-alpha7 are receptors for the extracellular matrix protein laminin. Previous work showed improvement of laminin deposition and muscle health in zebrafish dystroglycan mutants and integrin-alpha7 mutants after treatment with oxidized nicotinamide adenine dinucleotide (NAD+). NAD+ did not improve muscle health in GMPPB mutants. One hypothesis explaining these results is that in GMPPB mutants, hypoglycosylated dystroglycan cannot cluster because it lacks sugar sidechains, and this interferes with integrin-alpha7 clustering.
The localization of dystroglycan and integrin-alpha7 proteins relative to each other at the muscle cell membrane is hypothesized to be important. Using superresolution microscopy, images of Dystroglycan mutants versus GMPPB mutants treated and untreated with NAD+ will be analyzed to assess the average distance between the molecules of dystroglycan and integrin-alpha7 at the myofiber membranes.

1047. **Assessment of SIPA1L2 as a candidate modifier of CMT1A identified in human GWAS**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
George C. Murray, Graduate
Timothy J. Hines
Abby L. D. Tadenev

Faculty Mentor:
Robert Burgess

Abstract:
A case-only genome-wide analysis of CMT1A patients found four intronic SNPs in signal-induced proliferation-associated 1 like 2 (SIPA1L2) to be statistically associated with foot dorsiflexion strength. Furthermore, reduction of Sipa1l2 by siRNA reduced peripheral myelin protein 22 (Pmp22) expression along with other myelination-related genes in the SOX10 co-expression network in the S16 Schwann cell cell-line (Tao et al., 2019). Given that duplication of PMP22 causes CTM1A in humans, reduction of SIPA1L2 may therefore be a promising therapeutic approach. To better understand the normal function of SIPA1L2, to independently validate the genetic association between SIPA1L2 and PMP22, and to assess reduction in SIPA1L2 as a therapeutic strategy for CMT1A, we created a Sipa1l2 CRISPR knockout mouse. We are performing detailed neuromuscular phenotyping in the Sipa1l2 knockout mice, including gene expression analysis in peripheral nerves, to better understand its normal function and to test its place in the Sox10 co-expression network. In addition, the Sipa1l2 knockout mice have been bred with the C3-PMP22 mice, a transgenic model of CMT1A overexpressing human PMP22, which recapitulate decrements in nerve conduction velocity and eventual demyelination observed in patients (Verhamme et al., 2011). We will analyze the progeny from these crosses at four- and six-months-of-age by behavioral, neurophysiological, and histological methods to determine if reducing Sipa1l2 levels alters the C3-PMP22 phenotype. The outcomes of these studies will improve our understanding of the normal function of SIPA1L2 and will serve as an in vivo test of this rare disease GWAS hit and its potential as a therapeutic target for CMT1A.

1048. **Conformational Analysis of Iduronic Acid Containing Glycosaminoglycans Heparan Sulfate and Dermatan Sulfate**

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s):
Devon Martin, Graduate

Faculty Mentor:
Olgun Guvench

Abstract:
Heparan sulfate (HS) and dermatan sulfate (DS) are two of the most abundant proteoglycan biopolymers in the body and may contain hundreds of repeating disaccharide units of iduronic acid (IdoA) and N-acetylglucosamine (GlcNAc) for HS or N-acetylgalactosamine (GalNAc) for DS. Studying either HS or DS is difficult due to the inherent flexibility of the polymers owed to flexible glycosidic linkages and monosaccharide rings. Specifically, IdoA, one of the main components of both polymers, undergoes ring flips on the microsecond timescale. We performed unbiased all-atom explicit-solvent molecular dynamics (MD) simulations on both HS 10- ([-4IdoAβ1-4GlcNAcβ1-]5) and 20-mers ([-4IdoAβ1-4GlcNAcβ1-]10) and DS 10- ([-4IdoA1-3GalNAcβ1-]5) and 20-mers ([-4IdoA1-3GalNAcβ1-]10) to determine polymer conformation at atomic resolution as well as the possible contributions of IdoA conformation to backbone flexibility and polymer length to IdoA conformational flexibility. The data generated will be used to construct biologically relevant full-length HS and DS polymer ensembles.

1049. **Efficient construction of atomic-resolution models of glycosaminoglycans using molecular dynamics data**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Elizabeth Whitmore, Graduate
Gabriel Vesenka
Hanna Sihler
Olgun Guvench

Faculty Mentor:
Olgun Guvench

Abstract:
Glycosaminoglycans (GAGs) are physiologically-important biopolymers in animal tissue, specifically in extracellular matrix (ECM) as well as on and within cells. GAGs are linear, structurally diverse, conformationally complex, and may contain up to 200 monosaccharides. These characteristics present a challenge for studying GAG conformational thermodynamics at atomic resolution using existing experimental methods. Molecular dynamics (MD) simulations can overcome this challenge but are only feasible for short GAG polymers. To address this problem, we developed an algorithm that applies all conformational parameters contributing to GAG backbone flexibility (i.e. bond lengths, bond angles, and dihedral angles) from unbiased all-atom explicit-solvent MD simulations of short GAG polymers to rapidly construct models of GAGs of arbitrary length. The algorithm was used to generate GAG 10- and 20-mer ensembles which were compared to MD-generated ensembles. End-to-end distance distributions in constructed and MD-generated ensembles have minimal differences suggesting that our algorithm produces conformational ensembles that mimic the backbone flexibility seen in simulation. Additionally, GAG 100- and 200-mer ensembles were constructed within a day demonstrating the efficiency of the algorithm and reduction of time and computational cost compared to simulation.

1050. **Caloric Restriction and Fasting Diets have Negligible, or Potentially Damaging, Effects on Cognition in Diversity Outbred Mice**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Andrew Ouellette, Graduate
Niran Hadad
Andrew Deighan
Kristen O'Connell
Adam Freund
Gary Churchill
Catherine Kaczorowski

Faculty Mentor:
Catherine Kaczorowski

Abstract:
Aging remains the greatest risk factor for developing Alzheimer's disease (AD). Given the projected increase in lifespan across the globe, the risk of developing AD is expected to increase,

along with significant economic and social burden. As such, the demand for interventions that increase cognitive longevity in parallel with lifespan is high. Several studies have reported that caloric-restriction (CR) or fasting increase lifespan and improve cognition in humans and models of aging [1,2], but others have reported no beneficial effect of CR on cognition [3,4]. These discrepancies may be explained by uncontrolled environmental factors inherent in large human studies, and the lack of genetic diversity in previous animal studies where effects of CR or fasting on cognitive longevity studies in one inbred strain of mice may not generalize to other mouse strains, let alone to humans.
In this study, we compare the effects of Ad Lib, 1 day fast, 2 day fast, 20% CR and 40% CR on Y-maze working memory and contextual fear memory (CFM) in a genetically diverse population of mice - the Diversity Outbred (DO). We observed no benefit of CR or fasting on working memory or CFM at 24 months, an age when CR and fasting is known to increase survival compared to Ad Lib. Actually, the 40% CR group exhibited impaired long-term CFM compared to groups fasted for 1 and 2 days. These results emphasize the importance of identifying therapeutics to enhance cognitive longevity, as CR enhancement of lifespan may not generalize to cognitive abilities.

1051. **Characterizing the role of IRS1/2 in osteocyte differentiation and function in bone development**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Vivin Karthik, Graduate

Faculty Mentor:
Anyonya Guntur

Abstract:
Osteocytes are the most abundant cell type in skeletal bone and are present in the bone matrix. They form a network for sensing mechanical cues coming from the bone remodeling units which involve both the osteoblasts and osteoclasts. The former secretes collagen matrix and minerals and the latter resorbs the matrix after collagen breakdown. Osteocytes have been studied in the context of mechano-transduction biology and signaling, there are very few studies elucidating the role of osteocytes in metabolic homeostasis and bioenergetics. Insulin receptor substrate proteins 1 and 2 (IRS1/2), are scaffolding proteins involved in insulin and insulin growth factor-1 (IGF1) signaling necessary for the anabolic regulation of bone. Previous studies have shown that IRS1/2 have a role in glucose metabolism and homeostasis in the liver, along with being

primarily involved in the development of skeletal muscle and differentiation of osteoblasts. In this study, we aim to delineate the role of IRS1/2 in osteocyte metabolism and bioenergetics by knocking out IRS1/2 in osteocytes in mice using Dentin Matrix Protein (DMP1) Cre. Preliminary results through dual X-ray absorptiometry to measure bone mineral density (BMD) in 8-week-old mice show that Cre specific males and females have reduced BMD compared to wildtype littermates. Future studies would evaluate the bioenergetic profile of the IRS1/2 knockout osteocytes in vitro and the bone architecture of the trabecular and cortical bone through microCT analysis.

1052. **Prrx1-CreAlplfl/fl mice, a Model for Further Investigations into the Pathophysiological Changes in Hypophosphatemia.**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Victoria DeMambro, Graduate
Jennifer Daruszka
Daniel Brooks
Mary Bouxsein
Clifford Rosen

Faculty Mentor:
Clifford Rosen

Abstract:
Purpose/Background: Hypophosphatasia is caused by loss of function mutations in the tissue-nonspecific alkaline phosphatase (TNSALP) gene (Alpl) resulting in rickets, osteomalicia, bone fragility and lean body mass. In vitro, inhibition of TNSALP decreases adipogenesis suggesting TNSALP, an enzyme involved in mineralization, is pro-adipogenic. Alpl-/- mice die postnatally, to further delineate TNSALP's role in bone homeostasis and adipogenesis we are utilizing a Prrx1-Cre driver coupled to an Alplflfl (CreAlpflfl) mouse line.
Methods/Approach: CreAlpflfl and controls were evaluated by DXA at 8, 16 and 24wks of age (n=10/geno/gender). Metabolic cage analysis was performed at 24wks of age (n=8/geno/gender). At sacrifice serum, inguinal fat depots (IWAT), femoral and tibial bones were isolated for MicroCT/histological and gene/protein expression analysis. In vitro BMMSCs were differentiated into osteoblasts and adipocytes along with the stromal vascular fraction (SVF) from IWAT depots in CreAlpflfl and controls.

Results and Conclusions: CreAlpflfl mice exhibited reduced body weight, fat mass and femoral bone mineral density (BMD) vs. controls. CreAlpflfl IWAT depots exhibited reduced adipocyte size vs. controls. CreAlpflfl femurs had reductions in length, cortical thickness, area and BMD. Trabecular bone mass, thickness, number and spacing were also reduced in CreAlpflfl femurs. Metabolically, CreAlpflfl mice exhibited decreased activity and energy expenditure (EE). Preliminary BMMSCs cultures revealed decreased mineralization and increased adipogenic capacity in CreAlpflfl cells. Conversely, CreAlpflfl IWAT SVF cultures exhibited reduced lipid accumulation. In sum, studies of Prrx1-CreAlpflfl mouse model will aid in a greater understanding of the pathophysiological changes that occur in bone and fat in hypophosphatemia.

1053. **Chronic Cortisol Works Through the Transcription Factor Klf9 to Deregulate Immune Response and Metabolism**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Ian Gans, Graduate
Elli Hartig
Joel Graber

Faculty Mentor:
Jim Coffman

Abstract:
Elevated glucocorticoid (GC) hormones are associated with a number of disease states. Studies show that high GC during development can have life-long impacts on health. To understand underlying mechanisms, our lab uses treatment with chronic cortisol (CORT) in developing zebrafish, an emerging model for investigating GC signaling. We found that CORT during development alters a set point for the GC signaling axis, leading to continuous induction of elevated GC as well as immune gene dysregulation and impaired blood glucose homeostasis. To identify pathways perturbed by developmental CORT, we used RNA sequencing to compare wild type (WT) animals with mutants lacking either the glucocorticoid receptor (GRKO) or the transcription factor Klf9, a target of the GR. The results show similarities between CORT-treated WT and VEH-treated GRKO suggestive of GC resistance in WT. In Klf9 mutants, immune genes upregulated by CORT in WT were not similarly over-expressed, suggesting Klf9 mediates immune gene regulation by GC. CORT also increased expression of numerous metabolic genes in Klf9 mutants but not WT. To further investigate Klf9's metabolic role, respiration rate was

measured in live fish. Klf9 mutants consumed less oxygen, but mitochondrial respiratory capacity was unaffected. This, coupled with gene expression data, suggests Klf9 may regulate non-mitochondrial metabolic pathways such as glycolysis and/or peroxisomal beta-oxidation. Additional studies are required, but regulation of glycolysis by Klf9 would fit with the gene's known tumor-suppresive role, and regulation of peroxisomal metabolism could partially explain the role of Klf9 in mediating immune cells' responsiveness to CORT.

1054. **Evidence for Direct Projections of Corneal Primary Afferent Neurons to the Parabrachial Nucleus in Mice**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
Megan Tomasch, Graduate

Faculty Mentor:
Ian Meng

Abstract:
As the most densely innervated structure in the body, the cornea can be a useful model for studies related to the sensory processing of pain. The cornea is primarily innervated by small-diameter primary afferent neurons with cell bodies located in the trigeminal ganglia. Central projections from corneal primary afferent neurons to the brainstem trigeminal nucleus, for the relay of craniofacial pain, have been previously characterized. Here, we set out to assess if there is a direct pathway from corneal primary afferent neurons to the parabrachial nucleus, a structure involved in the processing of pain affect and autonomic responses. Using transgenic mouse models, tdTomato/Nav1.8cre and ArchT-GFP/Nav1.8cre, central projections of sensory neurons to the parabrachial region were visualized. The location of corneal-responsive neurons in the parabrachial nucleus was determined using immunohistochemistry for c-Fos protein after the application of mustard oil (20%) to the cornea. Analysis with confocal and 2-photon microscopy revealed the presence of both primary afferent nociceptors and Fos-positive neurons in close proximity. Next, to explore a possible direct pathway between the cornea and the parabrachial nucleus, we placed a neuronal tracer, DiI, on the cornea combined with intracranial injections of a retrograde tracer, Fluorogold, into the parabrachial nucleus. This revealed double labeling of corneal afferent cell bodies in the trigeminal ganglia, a direct projection from corneal afferents to the parabrachial nucleus. We have begun optimizing behavioral assays to evaluate the functional role of this pathway in corneal pain by optogenetically silencing or activating this pathway.

1055. **Comparision of CRISPR-X and EvolvR for Saturation Mutagenesis of HBE1 locus cis-regulatory elements**

Submission Type: Poster
Submission Category: Biomedical Sciences

Author(s):
John Butts, Graduate

Faculty Mentor:
Ryan Tewhey

Abstract:
cis-regulatory elements (CREs) are essential for the proper regulation of genes and the disruption of these cis-regulatory-gene relationships is associated with a spectrum of human diseases. As such, accurate modeling of disease variants represents an invaluable tool to study regulatory disease. Unlike genetic disease, most regulatory diseases cannot be directly modeled. Therefore an understanding of the logic underlying CREs is crucial to effective modeling. Saturation mutagenesis allows for generation of unbiased CRE variant libraries which, coupled with reporters, can provide expression data to elucidate the CRE's regulatory grammar.
Many techniques exist to perform the described mutagenesis utilizing CRISPR-Cas9. A disadvantage of traditional CRISPR-Cas9 is its reliance on indels. In response, techniques have been developed that utilize CRISPR-Cas9 localization while otherwise maintaining the wild-type enhancer background. Examples include CRISPR-X and EvolvR. We targeted three sites in the HBE1 locus for mutagenesis: the promoter, HS2, and a control. Using K562 HBE1:mCherry cells, the impact of mutagenesis can be determined by quantification of mCherry. Initial CRISPR-X experiments show successful, unbiased mutagenesis of the HBE1 Promoter. While CRISPR-X is designed for mammalian expression, EvolvR has not been performed in mammalian cells and requires modification. The dCas9 of the PX462 V2.0 vector has been converted to enCas9 by site directed mutagenesis. Furthermore, the EvolvR native EcoPol II was cloned and additionally synthesized in codon optimized form to compare effectiveness in the mammalian cells. Ultimately the two techniques will be compared for their use in future saturation mutagenesis experiments to further study the logic underlying CREs.

1056. **Identification, Notification, and Quantification of Bubbles in Microfluidic Systems**

Submission Type: Exhibit/Performance
Submission Category: Biomedical Sciences

Author(s):
Mikaella Sansoucie, Undergraduate
Bailey Corless
Julia Towne
Dr. Karissa Tilbury

Faculty Mentor:
Dr. Karissa Tilbury

Abstract:
Microfluidics have revolutionized biomedical assays; however, bubble formation in small assays present a significant problem in both clinical and research environments. Characterizing and flagging these bubbles as they appear is crucial to understanding and preventing errors. Current bubble sensors are designed for tubing, making them incompatible with viewing windows of devices using optical measurements. The goal of this project is to develop a way to address bubbles in low-volume fluidic samples that automates the identification, notification, and quantification of the disruptions. The device uses a camera to take a picture of a fluidic sample prior to testing and run the image through an image analysis program. If no bubbles are detected the program will reset until the next sample is loaded. If a bubble is detected, the program will alert the user and proceed to quantify the bubble(s) including their size, location, and the percent volume they occupy. The device's functionality was validated by testing its precision and accuracy to ensure bubbles are correctly characterized. The precision testing was performed by characterizing bubbles of the same size and examining variation between tests. The accuracy analysis was done by characterizing beads of known sizes to represent bubbles and comparing the device-determined size to non-automated methods. This work developing a device that can identify, notify and quantify the bubbles, will help ensure only accurate results are displayed in clinical and research settings.

1057. **Discovering Virulence Factors of Candida albicans that Affect Host Responses**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Emma Bragdon, Undergraduate
Bailey Blair

Faculty Mentor:
Robert Wheeler

Abstract:
Candida albicans is a commensal yet opportunistic pathogen. It is typically found in the mouth and gastrointestinal tract of humans. While healthy adults are not infected, immune-compromised individuals such as those going through chemotherapy are susceptible to infection. Understanding why these patients become susceptible may help us develop new strategies to prevent and treat these lethal infections. The innate immune system is the initial defense when intruders enter a system and is required for resistance against a pathogen. It recognizes a threat as soon as possible and recruits phagocytes to the threat site. However, C. albicans has known virulence factors, agents that allow an organism to cause disease in a host and escape the immune system. Out of virulence factors of C. albicans, adherence, secreted aspartyl proteases, and pleomorphism play the biggest role in infection. Adhesin promotes the adherence of C. albicans to host cells, secreted aspartyl proteases damage epithelial cells, induce macrophage chemotaxis and cytokine production, and pleomorphism refers to C. albicans ability to grow as a yeast or hyphae. A larval zebrafish model is a great way to understand and visualize how pathogens interact with the immune system. In this project the larval zebrafish model with fluorescent immune cells was used to visualize the interaction between immune cells and C. albicans in vivo. Mutant C. albicans strains lacking virulence factors were injected into the hindbrain of the zebrafish, and infection was observed and analyzed to draw conclusions on virulence factors that are most important in C. albicans infection.

1058. **Utilization of a novel approach to decode the mechanisms of a fatal viral brain infection**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Francesca Armstrong, Undergraduate
Michael Wilczek
Remi Geohegan
Melissa Maginnis

Faculty Mentor:
Melissa Maginnis

Abstract:
When we hear the word "virus," we commonly think of viruses that are currently spreading in the environment such as influenza or the novel coronavirus that generally cause acute infections but can result in severe complications. However, there are numerous viruses that reside within the

human host that have the potential to reactivate and cause serious disease. Human JC polyomavirus (JCPyV) infects 80% of the population and establishes a persistent, lifelong infection in the kidneys. In immunocompromised individuals, JCPyV can spread to the brain and infect glial cells, astrocytes and oligodendrocytes. Infection of these cells results in the fatal demyelinating disease known as progressive multifocal leukoencephalopathy (PML). Current research of JCPyV primarily uses techniques that require a mixed glial cell line known as SVG-A cells that were specifically designed to support JCPyV infection. Unfortunately, these cells do not accurately model infection in the human brain. Thus, we have established primary human astrocytes as an alternative approach to study JCPyV. This research will utilize biochemical and molecular biology techniques in order to address whether the host cell pathways necessary for JCPyV infection in SVG-A cells are required for infection in primary human astrocytes. These findings have proposed significant differences in the characteristics of JCPyV infection in SVG-A cells versus primary human astrocytes that may be vital in furthering our understanding of JCPyV infection propagation and PML pathophysiology. Furthermore, this research may possibly provide a platform for studying our neuroinvasive viruses with fatal outcomes.

1059. **Identifying the Link between Non-coding, Regulatory RNAs and Phenotypic Severity in Muscular Dystrophy**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Grace Smith, Undergraduate
Clarissa Henry
Mary Astumian
Michelle Goody
Erin Bailey
Benjamin King

Faculty Mentor:
Benjamin King

Abstract:
Muscular Dystrophy (MD) is characterized by varying severity and time-of-onset by individuals with the same forms of MD, a phenomenon that is not well understood. MD affects 250,000 individuals in the United States and is characterized by mutations in the dystroglycan complex. gmppb encodes an enzyme that glycosylates dystroglycan, making it functionally active; thus, mutations in gmppb cause dystroglycanopathic MD. The zebrafish (Danio rerio) is a powerful

vertebrate model for musculoskeletal development and disease. Like human patients, gmppb mutant zebrafish present both mild and severe phenotypes. In order to understand the molecular mechanisms involved, we performed high-throughput RNA Sequencing (RNA-Seq) and small RNA Sequencing at 4 and 7 days-post-fertilization (dpf) in mild and severe gmppb mutants and controls. We hypothesize that variable phenotypes in gmppb mutants are due to differences in gene regulation; therefore, we identified differentially expressed (DE) long non-coding RNAs (lncRNAs) and microRNAs (miRNAs) - both potent genetic regulators. We identified “MD-relevant” DE Ensembl-annotated genes involved in cell cycle regulation, the immune response, neural development and maturation, and skeletal muscle atrophy. We identified DE miRNAs that regulate these DE genes in the 4dpf severe mutants – identifying 55 of these interactions. We utilized a novel method of visualizing gene expression networks by generating co-expression networks of miRNAs and subsequently removing hubs to identify important miRNAs. We identified 95 potential lncRNAs for further analysis. By integrating analyses of both coding and non-coding genes, we contributed towards the understanding of the molecular mechanisms of Dystroglycanopathy, highlighting potential phenotypic modulators.

1060. **Lymphatic System as a Conduit for Immune Cells in Fat**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Thomas Szewczyk, Undergraduate
Magdalena Blaszkiewicz
Matthew Karp
James Godwin
Kristy Townsend

Faculty Mentor:
Kristy Townsend

Abstract:
The proper function of adipose (fat) tissue requires neural communication between this important metabolic organ and the brain. Therefore, maintaining nerve health in adipose tissue is of vital importance to overall metabolic health. Nerve health is maintained in part by neurotrophic factors – growth factors responsible for nerve survival and neurite outgrowth. We have identified a subset of immune cells in mice that home to adipose tissue upon cold-induced noradrenergic stimulation and express neurotrophic factor. We have named these cells, which express the Ly6c+CCR2+Cx3cr1+ markers, cold induced neuroimmune cells (CINCs). However,

mechanisms behind how CINCs home to adipose are not well understood. We studied the role of adipose lymphatics in recruitment of CINCs. Immunofluorescence imaging has been done on Cx3Cr1 reporter mice, which are genetically engineered to express the green fluorescent protein in CINCs, making them easy to visualize in adipose tissues. This imaging has revealed that CINCs reside in lymphatic vessels, are transported along the endothelial lining of lymphatic vessels, and are morphologically distinct from adipose resident Cx3Cr1 cells, as they show dendritic-like extensions when recruited to tissue. Further experimentation will examine the role of the subiliac lymph node (SiLN) in subcutaneous white adipose tissue, as it is a nexus of immune cell crosstalk, and we have shown neurite density to increase in this area after cold stimulation. Surgical removal and denervation experiments of the SiLN will reveal if it functions as a conduit for CINC recruitment to adipose and how this recruitment is affected by innervation.

1061. **Triclosan Disrupts Immune Cell Function by Depressing Ca2+ Influx via Acidification of the Cytoplasm**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Alan Baez, Undergraduate
Suraj Sangroula
Prakash Raut
Bright Obeng
Juyoung Shim
Grace Bagley

Faculty Mentor:
Julie Gosse

Abstract:
Triclosan (TCS) is an antimicrobial agent that was banned by the FDA from hand soaps in 2016, hospital soaps in 2017, and hand sanitizers in 2019; however, TCS can still be found in various products. The Gosse lab previously observed that TCS inhibits mast cell and mitochondrial function. Mast cells are a ubiquitous immune cell type that depend on Ca2+ influx into the cytosol for proper function. The Gosse lab previously showed that TCS depolarizes the mitochondrial membrane, disrupts mitochondrial structure, and inhibits Ca2+ dynamics in mast cells, and here we show that TCS also inhibits Ca2+ in human Jurkat T-cells. However, the molecular mechanism behind the Ca2+ dampening has yet to be elucidated. In this work, we show, using 3D super-resolution microscopy, that TCS induces mitochondrial swelling, a further

indication of TCS inhibition of mitochondrial membrane potential. Additionally, inhibition of the plasma membrane electrochemical potential (PMP) can inhibit mast cell function. However, we also show in both mast cells and T-cells, using the genetically encoded voltage indicators (GEVIs) ArcLight (pH sensitive) and ASAP2 (pH insensitive), that TCS does not disrupt PMP, but rather induces acidification of the cytosol, at consumer-relevant, non-cytotoxic, doses. Additionally, preliminary data gathered using a dedicated, membrane-localized, pH-sensitive fluorophore (pHlourin) also suggests TCS-induced cytosolic acidification. Acidification of the cytosol has previously been linked to Ca2+ influx inhibition, thus providing a mechanistic explanation of triclosan's disruption of Ca2+ influx and, thus, of immune cell function.

1062. **Innate Immune Response to Influenza Type A in a Zebrafish Model**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Brandy-Lee A. Soos, Graduate
Benjamin King

Faculty Mentor:
Benjamin L. King

Abstract:
The World Health Organization estimated 650,000 deaths per year occur worldwide from respiratory diseases associated with seasonal influenza infections. Influenza A virus (IAV) can result in severe respiratory complications due to hyperinflammation and poor viral clearance in children, senior adults, and immune-compromised individuals. Our long-term goal is to understand how the innate immune response to IAV infection transitions from clearing virus infection to a hyperinflammatory response that can lead to tissue damage and death. Studies demonstrate the importance of neutrophil recruitment and phagocytosis in response to bacterial and fungal infections yet their role in antiviral responses are poorly understood. Recently, it was demonstrated that IAV infection can be established in zebrafish (Danio rerio) larvae. The zebrafish is a powerful vertebrate model system that has been used to study infection and innate immunity. We are using this model to study the roles neutrophils have in controlling IAV infection and how over-activation of neutrophils during IAV infection trigger a damaging hyperinflammatory response. First, we are examining pathways that control the respiratory burst function and how reactive oxidative species control neutrophil function during IAV infection. Second, we are investigating how hyperinflammation occurs during IAV infection so that therapeutic measures that preserve the antiviral response, yet contain the associated

inflammation, can be developed. This work is supported by the National Institute of Allergy and Infectious Disease of the National Institutes of Health under grant number R15AI131202 and the National Institute of General Medical Sciences under grant number P20 GM103423.

1063. **Role of MicroRNAs in Regulating the Innate Immune Response to Pseudomonas aeruginosa Infection.**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Liz Saavedra, Graduate
Brandy Soos
Benjamin King

Faculty Mentor:
Benjamin L. King

Abstract:
Cystic Fibrosis (CF) is a genetic disorder in which patients express a defective cystic fibrosis transmembrane conductance regulator (CFTR) protein and develop chronic Pseudomonas aeruginosa (PA) lung infections. Previous studies have identified defects in innate immune function with defective CFTR function and low-dose arsenic exposure. We utilize the zebrafish (Danio rerio) as a model system to study the innate immune response to infection. MicroRNAs (miRNAs) are highly conserved, single-strand noncoding RNAs that regulate the expression of protein-coding genes. We hypothesize that miRNAs regulate genes involved with the respiratory burst response during the innate immune function. The long-term goal of our research is to understand how noncoding RNAs regulate the innate immune response upon chemical exposure and/or PA infection and to identify the mechanisms that lead to an impaired immune response. Survival and bacterial burden were characterized in 24 hours post-fertilization embryos. Test groups included PA infected control/cftr morphants versus uninfected control/cftr morphants exposed to increasing levels of arsenic (0, 2, and 10 ppb). miRNA expression was then analyzed using small RNA sequencing at 6, 12, and 18 hours post-infection. 35 miRNAs were differentially expressed with PA infection in control morphants exposed to 0 ppb arsenic. Dre-Let-7-P1a_5p miRNAs had a significant interaction between CFTR knockdown and 10 ppb arsenic exposure. One of these miRNAs, Dre-Mir-1-P1_3p, was upregulated with infection in CFTR morphants exposed to 10ppb arsenic, downregulated in infected control morphants with 10 ppb arsenic exposure. These studies, combined with gene expression studies, will provide

new insight into the mechanisms of innate immune responses and inform the development of new therapies for CF patients.

1064. **Sclerostin Antibody Normalizes Decreased Trabecular Bone and Increased Bone Marrow Adipose Tissue Caused by Whole-body Irradiation in Mice**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Samantha Costa, Graduate

Faculty Mentor:
Michaela Reagan

Abstract:
Irradiation (IR) negatively affects the bone marrow (BM) through increased osteoclast activity, decreased osteoblast activity, and increased adipocyte expansion. Patients receiving IR are at increased risk for bone deterioration and other skeletal-related events.
We hypothesized antibodies to sclerostin (Scl-Ab) would reverse the adverse effects of IR by increasing bone volume and decreasing BM adipose tissue (BMAT), resulting in improved bone quality. In this study, 12-week-old female C57BL/6J mice were exposed to 6Gy whole-body IR or were non-irradiated (Non-IR), then administered Scl-Ab (25mg/kg) or vehicle weekly for 5 weeks. Tibial µCT analysis confirmed IR decreased trabecular bone volume (Tb.BV/TV) by 43.1% Scl-Ab increased Tb.BV/TV by 2.45 fold in IR and 2.22 fold in Non-IR mice compared to vehicle.
Femoral histomorphometry revealed IR did not affect the number of osteoblasts or osteoclasts, but rather the overall efficacy of these cells. Scl-Ab improved bone parameters by increasing osteoblast function (e.g. bone formation rate and mineral apposition rate). BM adiposity within the femoral metaphysis and whole tibia increased following IR; Scl-Ab diminished this effect in the femoral metaphysis ($p=0.0182$) and distal tibia ($p=0.002$).
Overall, our data support the hypothesis that Scl-Ab ameliorate the deleterious effects of IR on trabecular bone and BMAT in a mouse IR model. This suggests further research into cellular function modulation after IR insult are warranted.

1065. **Uncovering Candida Albicans Factors That Modulate the Host Phagocyte Response**

Submission Type: Oral Presentation

Submission Category: Biomedical Sciences

Author(s):
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Emma Bragdon
Lena Stasiak

Faculty Mentor:
Robert Wheeler

Abstract:
The ability of C. albicans to evade the host immune system helps it to be a successful pathogen, but little is known about how C. albicans achieves this. Previous work suggests that the ability of C. albicans to switch to hyphal growth may help limit the recruitment of phagocytes to the infection site, but the mechanism responsible for this is not yet understood. In order to further understand this, we are using the larval zebrafish infection model to screen a large number C. albicans mutants for virulence. Virulence in this model has previously been observed to be linked to the phagocyte response early in infection. This is the first screen of this scale to look at the virulence of C. albicans mutant strains in a live host. This has led to a number of mutants that show a virulence defect, many that have not previously been characterized for virulence. Transgenic zebrafish are now being used to investigate the phagocyte response to hypovirulent mutants. This allows us to identify important genes and pathways for limiting the host phagocyte response. Furthermore, we can identify factors that limit different stages of the phagocyte response such as recruitment and engulfment. Preliminary data with one hypovirulent mutant suggests that deletion of a single fungal cell wall protein enhances uptake by host macrophages in the zebrafish. This work will allow us to gain valuable insight into C. albicans factors that influence the host phagocyte response and evade immune attack.

1066. **The Meninges and Choroid Plexus are Prominent mTert-Expressing Adult Stem Cell Niches in the Mouse Brain**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Gabriel Jensen, Graduate

Faculty Mentor:
Kristy Townsend

Abstract:
Adult neurogenesis persists throughout life in the adult mammalian brain in discrete regions, including the subventricular zone (SVZ) of the lateral ventricles and the hypothalamus. Within these ventricular niches, the choroid plexus produces cerebrospinal fluid (CSF) which distributes various growth factors that modulate this process. Changes in CSF composition affect the neurogenic and migratory capabilities of adult neural progenitor cells that reside within the SVZ. The choroid plexus and meninges also contain stem-like cells that form neurospheres and differentiate into neurons and glia in vitro. We have identified a population of cells within the adult murine choroid plexus, SVZ, hypothalamus, and meninges that express telomerase reverse transcriptase (Tert). Tert is expressed by regenerative, slowly cycling stem cells in many adult organs. A population of Tert+ cells in the brain express the proliferation marker Ki67, but do not express progenitor or mature neuron markers. Lineage tracing of Tert+ cells in adult mice shows drastically increased numbers of labeled cells within the choroid plexus, SVZ, hypothalamus, and meninges when compared to direct reporter mouse lines. The presence of proliferative Tert+ cells that repopulate major neurogenic niches and lack expression of neural progenitor cell markers or mature neuron markers leads us to conclude that Tert+ cells are a previously undiscovered population of adult neural stem cells in the adult mammalian brain.

1067. **Drawing the road map to JC Polyomavirus infection in the brain: Using bioinformatics to elucidate the cell signaling pathways activated upon virus infection**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Michael Wilczek, Graduate
Francesca Armstrong
Remi Geohegan
Melissa Maginnis

Faculty Mentor:
Melissa Maginnis

Abstract:
Bioinformatics is revolutionizing the way we approach biomedical research. The human cell has ~20,000 protein-coding genes, which are important for cell survival and growth. Viruses upon infection, commander the regulation of many genes to hijack the cell, replicate inside it, and thus result in human disease. Conventional biomedical approaches would delay discoveries, but bioinformatic approaches allow the researcher to determine the significance of each gene during

virus infection and elucidate therapeutic targets towards human disease. Most of the population is infected with JC polyomavirus (JCPyV), which can cause a deadly infection in the brain. In healthy individuals, the virus persists in the kidneys as a symptomless infection. During immunosuppression, the virus can reactivate and spread into the brain, infecting two main cell types. The destruction of these cells leads to the fatal disease, progressive multifocal leukoencephalopathy (PML). Currently, there are no effective treatments for PML, and it is fatal. To determine the genes influenced during JCPyV infection, bioinformatic techniques can be used to understand how the virus hijacks the cell. Currently, we have discovered the cellular pathways important in JCPyV infection, including the mitogen-activated protein kinases (MAPK), a pathway critical in cellular proliferation and survival. Furthermore, using infectivity assays, siRNA, and quantitative immunofluorescence assays, we validated the importance of the MAPK pathway and other cellular pathways involved in JCPyV infection of NHAs. Using bioinformatics and experimental validation, we will enhance our understanding of PML pathogenesis and define the role of astrocytes in this deadly disease.

1068. **Defining Localization Dynamics of 5-HT2 Receptor Subtypes in JCPyV Entry Using Super-Resolution Localization Microscopy**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Kashif Mehmood, Graduate
Jeanne DuShane
Matthew Parent
Michael Wilczek
Colleen Mayberry
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Faculty Mentor:
Melissa Maginnis

Abstract:
Among human-specific viruses, JC polyomavirus (JCPyV) asymptomatically infects most of the adult population and remains controlled by the immune system in healthy individuals. JCPyV can reactivate in immunocompromised individuals and relocate to the brain, leading to the fatal demyelinating disease called progressive multifocal leukoencephalopathy (PML). Patients receiving immune-modifying drugs or suffering from immune-mediated disorders such as HIV/AIDS remain at high risk for PML development, and unfortunately the disease remains

incurable. Studying the viral attachment and entry mechanisms in host cells is crucial for understanding viral infectivity and disease pathogenesis. Previous studies demonstrate that JCPyV requires α2,6-linked sialic acid receptors for attachment, and viral entry is mediated by 5-hydroxytryptamine 2 (5-HT2) receptor subtypes. However, JCPyV interactions with 5-HT2 receptors is not well understood due to limitations of resolution in conventional fluorescence microscopy techniques. Super-resolution microscopy techniques provide an innovative method to characterize the spatial and temporal dynamics of 5-HT2 receptors during JCPyV infection. We utilized fluorescence photoactivatable localization microscopy (FPALM) to demonstrate that JCPyV localizes with 5-HT2 receptor subtypes that are expressed in photoactivatable Dendra2 constructs within transfected cells. Our findings indicate that viral localization varies between the different 5-HT2 receptor subtypes. These data improve our knowledge and understanding of JCPyV interactions with 5-HT2 receptors for entry into host cells. Using super resolution microscopy and image analysis, we can better understand the spatial and temporal patterning of virus-receptor interactions. These findings can be applied to the future development of an antiviral therapy for JCPyV infection and prevention of PML.

1069. **Wound-Induced Polyploidization Enables the Drosophila Abdominal Epithelium to Adapt and Become Muscle-Like to Restore Tissue Mechanics**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Kayla Gjelsvik, Graduate

Faculty Mentor:
Vicki Losick

Abstract:
Polyploidy frequently arises in response to injury, disease, and age-related tissue degeneration. Despite its prevalence, major gaps exist in our understanding of how polyploid cells affect tissue function. In the adult Drosophila epithelium, wound healing is dependent on the generation of multinucleated polyploid cells by endoreplication and cell fusion, resulting in a permanent change in the abdominal epithelial architecture. Here, we study how wound-induced polyploidization (WIP) affects tissue function by altering tissue mechanics. We have found that the mechanosensor, non-muscle myosin II is upregulated and activated during wound healing. Myosin activation is dynamic and required not only early to facilitate wound closure, but persists in the polyploid cells after healing completes. The upregulation and phosphorylation of Myosin suggests that polyploid cell growth alters tissue mechanics. Using laser microsurgery, we found

that the relative epithelial cell tension is significantly enhanced in polyploid cells compared to diploid cells. The enhanced tension is dependent endoreplication post injury, but ectopic endoreplication in the uninjured epithelium is not sufficient to induce this tension. Injury to the fly abdomen also damages the underlying lateral muscle fibers, which are permanently severed. These muscle fibers are required for abdominal movements, including bending. Remarkably, we found that the polyploid epithelial tension mimics that of the lateral muscle fibers and inhibition of polyploid cell growth after injury reduces abdominal bending. In conclusion, we have found that WIP is an adaptive healing strategy that enables the epithelium to restore tissue mechanics.

1070. **Murine Myeloma Model Demonstrates Correlation Between Body Composition and Tumor burden**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
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Heather Campbell
Michaela Reagan

Faculty Mentor:
Michaela Reagan

Abstract:
Myeloma is a cancer of plasma cells that can eventually spread to the bone to cause destruction. Recent epidemiological studies have shown a correlation between obesity, early adult BMI, and weight cycling with myeloma risk. We decided to explore these findings by measuring the tumor burden, body composition, and survival of SCID-Beige mice inoculated with MM.1S<gfp+luc+> human myeloma cells after having been on either a high fat diet (HFD), 60% kcal from fat, control diet (CD), 10% kcal from fat, or weight cycling (HFD>CD>HFD>CD). Diet administration was for a duration of sixteen weeks prior to tumor inoculation and these regimens induced substantial variability in body composition and weight gain within each group. In vivo bioluminescent imaging demonstrated mice on both HFD ($p<0.001$) and weight cycling ($p<0.05$) regimens were associated with significantly elevated tumor burden at early time points. While no significant results were detected in later disease stages with diet stratification, the mice that weighed the most versus mice that weighed the least had significantly elevated tumor burden ($p<0.01$) at later disease stages regardless of diet, with consistent trends for this association at earlier time points. We are in the process of testing the same conditions with the C57BL6J VK*Myc model to incorporate any potential modulation of the immune system by diets that was

not present in our first model. We anticipate that our new immunocompetent model will produce the same results as our first immunodeficient model, specifically regarding the association between elevated weights with increased tumor burden. These combined findings will provide insights into myeloma disease progression. By observing the relationships involving weight, body composition, diet and tumor burden we hope to identify novel implications for clinical prevention, intervention, and treatment of myeloma.

1071. **DGAT Activity is Dispensable for Myeloma Cell Proliferation**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Connor Spencer Murphy, Graduate

Faculty Mentor:
Michaela Reagan

Abstract:
Multiple myeloma (MM) is a blood cancer defined by the clonal expansion of malignant plasma cells in the bone marrow (BM). MM remains incurable due to the development of drug resistance; therefore, it is paramount to investigate novel treatments and the mechanisms of drug resistance in myeloma cells (MCs). Changes in lipid metabolism have been shown to support the proliferation and the development of drug resistance in other cancers. However, the role of lipid metabolism in MCs has been understudied. Therefore, we hypothesized that lipid metabolism contributes to MC proliferation. The role of global lipid metabolism in MC proliferation was tested by treating MCs with Triacsin C (TriC), an inhibitor of both catabolic and anabolic lipid metabolism. TriC treatment severely and specifically decreased MC proliferation and increased apoptosis in a dose-dependent manner. To understand the mechanism of TriC's toxicity, we explored anabolic lipid metabolism and observed that MCs accumulate lipid droplets (LDs), express LD-related transcripts and use LDs as an energy source. Interestingly, treatment with inhibitors against the rate-limiting enzymes responsible for the formation of LDs did not alter the proliferation of MCs. Our data suggests that global lipid metabolism is critical for myeloma cell proliferation while lipid droplet formation is dispensable. Future directions will explore the role of catabolic lipid metabolism with respect to MC proliferation and drug resistance.

1072. **Utilizing Mouse Telomerase Reverse Transcriptase (mTERT) As a Novel Adult Stem Cell Marker to Visualize Adult Cell Turnover in the Mouse Brain.**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Ashleigh Beaulieu, Graduate
Gabriel S. Jensen
Lydia Caron
Kristy Townsend

Faculty Mentor:
Kristy Townsend

Abstract:
Limited cells in the brain retain neurogenic or stem cell capabilities after development. Known as adult stem cells (ASCs), they can proliferate and differentiate into various mature cell types like neurons and glia, making them essential for replacement of lost cells due to normal tissue turnover or injury. ASCs were previously thought to reside mainly within two niches in the adult mammalian brain, however, emerging evidence has also shown neurogenic potential in other adult brain regions. Of the classical neurogenic niches, ASCs in the subventricular zone (SVZ) of the lateral ventricles supply newborn neurons to the olfactory bulb and are able to respond to signals from neighboring cells, cerebral spinal fluid, and vasculature. Thus, the adaptive nature of this plastic niche makes it a relevant target for treatments for neurodegeneration or traumatic brain injuries. Currently the field of neurogenesis research lacks a specific and unique marker to study ASCs, hindering our ability to investigate the behavior of these cells. We hypothesized that mouse telomerase reverse transcriptase (mTERT), a protein responsible for replenishing telomeres after cell division to inhibit replicative senescence, would be a unique and specific marker for ASC populations in the adult mouse brain. mTERT also marks adult stem cells in the intestine, heart and kidney. We have identified cells expressing mTERT in neurogenic regions, including in the SVZ, cerebroventricular lining, olfactory bulb, cerebellum, and hypothalamus. These mTERT+ ASCs do not co-express any markers of activated ASCs or neuroblasts, suggesting that they are quiescent stem cells. Using inducible lineage tracing techniques, we have investigated the fate of mTERT-expressing cells across multiple time points, revealing an increase in lineage traced mature cell types in neurogenic regions after a 4-14wk chase. Ongoing work is establishing changes in plasticity from mTERT+ precursors in various niches of the adult brain.

1073. **Engineering Zebrafish Constructs to Test Whether Muscle-Disease Associated MYLPF Variants are Sufficient to Impair Sarcomere Assembly**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Teresa Easterbrooks, Graduate

Faculty Mentor:
Jared Talbot

Abstract:
Distal Arthrogryposis (DA) is a congenital, genetically-linked disease of muscle development characterized by muscle weakness and contracture of limbs. A recently discovered DA gene, MYLPF, has a zebrafish homolog, mylpfa, that when knocked out leads to a similar phenotype in fish to the DA phenotype (muscle weakness and limb paralysis). These symptoms are explained by sarcomere assembly defects that we find in the mylpfa mutant. These findings suggest that loss of Mylpf function causes DA in humans and DA-like symptoms in zebrafish. However, it remained unclear whether the specific gene variants linked to human DA (residues Gly163 and Cys157) affect protein function. We designed a method for expressing human MYLPF protein (wild-type and disease-associated variants) in place of the zebrafish Mylpfa to investigate variants' impacts on sarcomere formation in muscle development. Briefly, we will produce a plasmid containing human MYLPF cDNA with polyadenylation sequences and use CRISPR to insert this plasmid into the second intron of zebrafish mylpfa; the inserted human sequences will replace over 80% of the native mylpfa coding sequence. Over the course of the rotation, I designed CRISPR guide RNAs targeting this mylpfa intron, tested their activity in fish, optimized dosage, and in the end found a viable guide RNA for use in line construction. In case new guide RNAs need to be designed, I also characterized polymorphisms in mylpfa intronic sequences. My findings lay the groundwork towards generating zebrafish lines that will test whether the Gly163 and Cys157 protein variants are sufficient to impair sarcomere assembly.

1074. **Rab27a in Exosome Function in Perivascular Adipose Tissue**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
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Anne Harrington

Faculty Mentor:
Lucy Liaw

Abstract:
Perivascular adipose tissue (PVAT), an adipose depot, surrounds the vasculature of humans and mice. In healthy and non-obese mice, PVAT exhibits a thermogenic phenotype and confers vascular health. Conversely, in obese mice, PVAT exhibits a lipid storage phenotype which is detrimental to vasculature. When comparing endogenous protein expression between healthy and obese mice, we found a significant increase in Rab27a. A member of the Ras-related brain protein family, Rab27a is a trafficking protein that regulates the formation and secretion of exosomes. Misregulation of exosome secretion has been linked to various diseases including type II diabetes and increased heart muscle deterioration. However, the role of Rab27a has yet to be defined in PVAT regarding exosome secretion and cardiovascular disease (CVD). We hypothesized that increased Rab27a expression in PVAT during obesity alters the function of secreted exosomes.
To test our hypothesis, we developed a novel Rab27a global knockout mouse, characterized by an ashen coat color that mimics Griscelli's syndrome in humans. This mouse strain also shows resistance to weight gain compared to wild type mice on a high fat diet. Immunoblot comparison of endogenous exosome markers between different adipose depots from wild type mice suggest that PVAT has a unique capability to secrete exosomes. We have also begun characterizing exosomes secreted from our PVAT APCs utilizing Tunable Resistive Pulse Sensing. With this technique, we discovered that upon differentiation, PVAT exosome secretion increases substantially. This suggests that PVAT exosome secretion is dependent on the cell's metabolic state.

1075. **Rab27a Expression in Perivascular Adipose Tissue Changes Upon Differentiation**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Caitlin Stieber, Graduate
Joshua Boucher

Jacqueline Turner
Lucy Liaw

Faculty Mentor:
Lucy Liaw

Abstract:
Introduction: Obesity is one of the strongest risk factors for cardiovascular disease. Cellular interactions between adipose tissue and the vasculature may explain this link. Perivascular adipose tissue (PVAT) surrounds most vessels and exerts a paracrine effect on the underlying blood vessel. Rab27a regulates protein and trafficking. We hypothesize that Rab27a in PVAT mediates local paracrine signaling to the vessel wall during cardiovascular disease.
Hypothesis: We assessed the hypothesis that Rab27a is dynamically regulated in murine PVAT during diet-induced obesity and differentiation.
Methods: C57BL/6J male mice were fed a 60% high fat diet for 12 weeks starting at 8 weeks of age. Body weight and fat and lean mass were determined. Immunoblot was used to assess Rab27a levels. Using primary pre-adipocytes derived from murine PVAT, 3D adipospheres were generated for in vitro study. Adipospheres were differentiated, and probed for lipid markers and Rab27a.
Results: High fat diet resulted in increased expression of Rab27a in PVAT in vivo. Adipospheres showed specific staining for lipid markers and Rab27a. Rab27a expression is more localized as differentiation time increases.
Conclusions: High fat diet leads to increased Rab27a levels in PVAT, which will be studied further to examine Rab27a control of adipogenesis. We demonstrated the feasibility of adapting 3D cultures for murine PVAT, the ability to differentiate spheroids using standard adipogenesis differentiation conditions, and have shown temporal changes of Rab27a expression with differentiation in murine adipospheres. We are currently using the model to test the expression of RAB27a during differentiation in human derived PVAT adipose progenitor cells.

1076. **Progression of Cardiomyogenesis from Embryonic Stem Cells in a Three-Dimensional Gel Matrix**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
Jonathan Bomar, Graduate

Faculty Mentor:
Rosemary Smith

Abstract:
Cardiovascular disease (CVD) accounts for about one in three deaths in the United States. Traditional therapies aim to minimize damage caused by CVD, but do little to address the loss of healthy heart tissue following acute injury. Engineered cardiac tissue has emerged as a promising therapy for cardiac tissue repair. In this project, HM1 mouse embryonic stem cells suspended in a three-dimensional gel matrix are differentiated in vitro into functional cardiac tissue with a highly reproducible, complex spatial cooperation of multiple cardiac cell types. A field of proliferative fibroblasts grows out from the cell-seeded matrix onto a glass substrate at approximately day 3 of differentiation. A spontaneously contracting network of myosin heavy chain (MHC)-positive cardiomyocytes self-organizes on top of the fibroblasts directly outside the original matrix at approximately day 10.5. This self-organization holds the key for the mechanism behind in vitro cardiomyogenesis. We hypothesize that boundary cues and cell-cell interactions signal the organization and outgrowth of fibroblasts from the matrix onto the glass substrate, followed by cardiomyocyte precursors which require the fibroblast outgrowth in order to further differentiate. Short term specific aims are to map the spatiotemporal development of cell types in the tissue, identifying self-organization induced by boundary conditions. Long term goals are to use these mechanisms of in vitro cardiomyogenesis to engineer cardiac tissue for in vitro drug testing and in vivo cardiac tissue grafts.

1077. **Sending Signals: Adipose Sensory Nerves May Communicate to the Brain via Lipid Metabolites**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
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Jake Willows

Faculty Mentor:
Kristy Townsend

Abstract:
Obesity and its related co-morbidities, such as type II diabetes, have reached pandemic proportions affecting millions worldwide. Current research aims to identify molecular mechanisms that may provide treatment and/or prevention options for these diseases. Diet is one

contributor to energy balance. If energy intake exceeds energy output, individuals become susceptible to metabolic disease. The type of energy intake is crucial and certain dietary fats, such as n-3/n-6 polyunsaturated fatty acids, may promote beneficial metabolic activity. Through unbiased lipidomics, in which white adipose tissue (WAT) compositions were compared, we uncovered that dietary intake of specific fatty acids alters WAT lipid composition. Interestingly, mice fed an n-6 enriched diet produced higher concentrations of pro- and anti-inflammatory signaling lipid metabolites in subcutaneous WAT (scWAT), compared to n-3 or saturated fat enriched diets. A robust increase of a specific octadecanoid, 13-HODE, was observed in scWAT following the n-6 enriched diet. Some octadecanoids are known to activate the calcium permeable transient receptor potential (TRP) channels located on sensory nerves. We have shown that the TRP channel TRPV1 is expressed on sensory nerves in mouse scWAT. Additionally, the lipid 13-HODE is capable of activating TRPV1 channels, thereby uptaking intracellular calcium. We have used intravital imaging of calcium uptake in mouse scWAT sensory nerves using a fluorescent calcium indicator upon 13-HODE delivery. Currently we are investigating the metabolic contributions of 13-HODE activation of TRPV1 expressing sensory nerves by assessing adipose, sensory ganglia, and hypothalamus following 13-HODE administration to scWAT.

1078. **The Mechanisms of TAp63-dependent and -independent DNA Damage Response in Meiotically Arrested Oocytes**

Submission Type: Oral Presentation
Submission Category: Biomedical Sciences

Author(s):
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Chihiro Emori
Zachary Boucher

Faculty Mentor:
Ewelina Bolcun-Filas

Abstract:
Development of aggressive cancer treatments increases patient survival rates, however the genotoxicity of these lifesaving treatments leave female cancer survivors facing risk of premature ovarian failure. Cancer treatments induce DNA double strand breaks (DSBs) preferentially killing cancer cells, but can also kill healthy cells. In somatic cells, DSBs activated DNA damage response (DDR) pathway leading to CHK2-dependent activation of p53. Active p53 induces senescence, cell cycle arrest or apoptosis. Arrested oocytes largely utilize the same DDR; however CHK2 primarily activates TAp63. TAp63 is exclusively expressed in oocytes in

the ovary and its activation by DSBs induces apoptosis of oocytes before DNA repair occurs. At low-dose irradiation (IR), wild type and *p53-/-* female mice are depleted of arrested oocytes and become infertile, while TAp63-deficient females retain oocytes and fertility. This suggests that TAp63 plays a major role in oocyte apoptosis after DNA damage. In contrast, at high-dose IR the majority of TAp63-deficient oocytes are eliminated suggesting that elimination of oocytes with higher levels of DNA damage activates TAp63-independent mechan ism. We hypothesize that p53 is involved and its activation is regulated by oocyte-specific factors. Our goal is to resolve relative contribution of these two proteins to DNA damage-induced oocyte death and define factors regulating their activation. Preliminary data supports this hypothesis as *TAp63-/- p53-/-* females receiving high-doses IR retain oocytes. Defining oocyte-specific factors regulating responses to DNA damage will allow us to target unique DDR pathways to prevent oocyte loss, infertility, and premature ovarian failure in patients receiving cancer treatments.