4-19-2024

2024 Student Symposium Program and Book of Abstracts

Center for Undergraduate Research

MAINE 2024 Student Symposium

Research and Creative Activity

Program and Book of Abstracts

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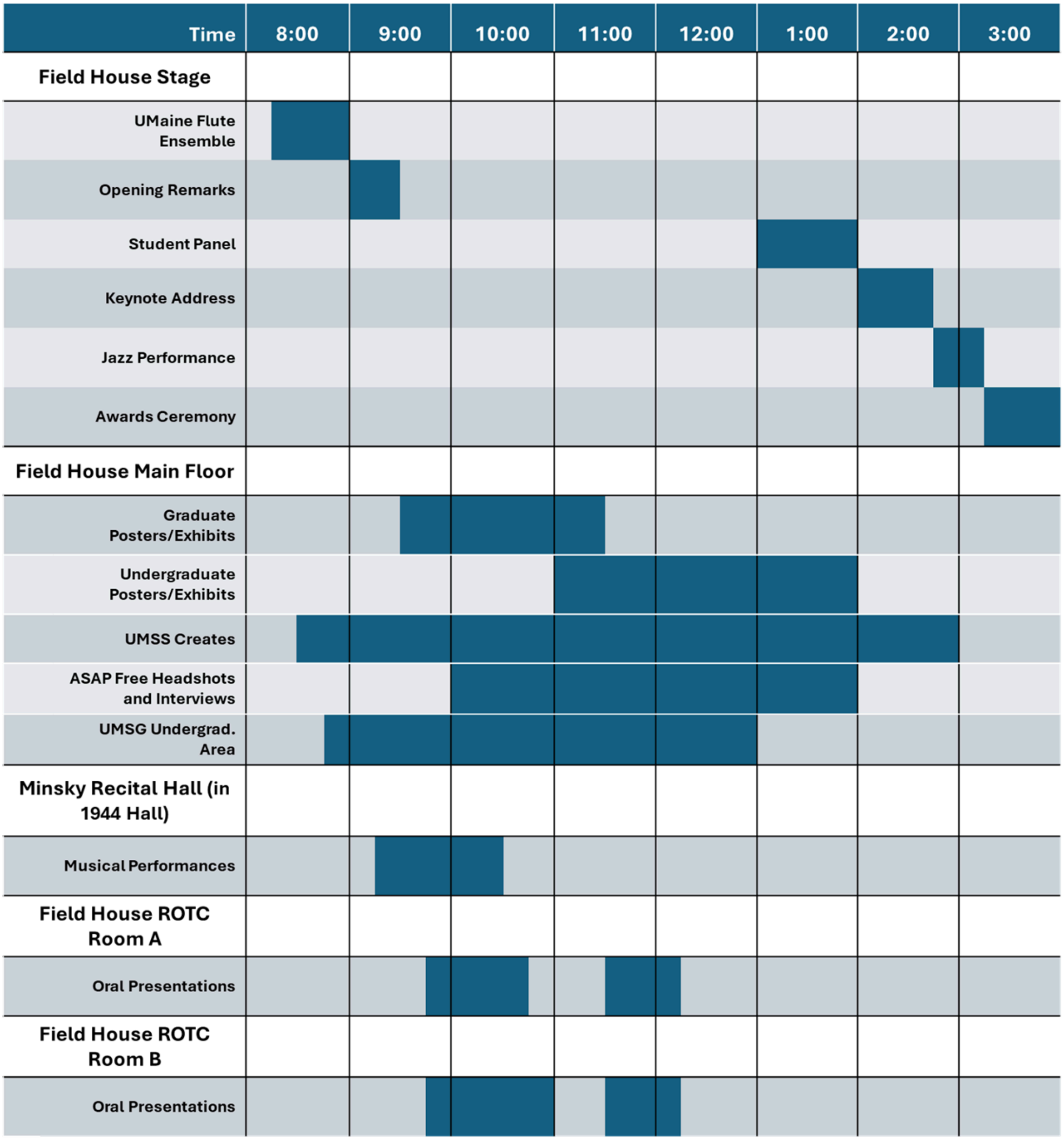

Special Events and Spaces

Please join us at

MAINE Student Symposium CREATES

In this environment you will have opportunities to create:

Ideas

Your opportunity to help identify and share unique challenges our community faces.

Solutions

Consider two challenges facing our community and start being part of the solution.

Connections

Meet with others from our community who are also interested in sharing their ideas and talents.

Come share your insight, knowledge, and skills to help create a better community!

Available 8:30 am - 3:00 pm

Special Events and Spaces

Check out our content:

sap media services

is coming to the

UMaine Student Symposium

Presenter Headshots

Get your picture taken by one of our talented staff with professional gear. Great for LinkedIn profiles or resumes!

Student Interviews

Showcase your research and have a chance to be featured on the Maine Journal YouTube channel!

VEMI LAB

Available 10:00 am - 2:00 pm

Special Events and Spaces

Special Events and Spaces

MAINE Student Symposium
Research and Creative Activity

Keynote Address:

Consequences of Approximations in Science and Engineering

Sreeram "Ram" Dhurjaty, PhD

Senior Member of IEEE

April 12th, 2:45-3pm, UMaine Field House Stage

Abstract: All of us approximate. Engineering and science are full of approximations. When we approximate, adequately, we reach our goals. Improper approximations can be disastrous and can have tragic consequences depending on the context they are made. In this talk, I will illustrate, with simple examples both adequate as well as inadequate approximations and their consequences. These consequences can be life-threatening, in certain contexts

Speaker Biography: Ram has an impressive educational background, having earned degrees from the Indian Institute of Technology, Bombay and Yale University. His work experience spans various roles, including his current position as President of Dhurjaty Electronics Consulting LLC, and his past roles at Kodak and other companies, where he contributed significantly to the development of innovative medical devices and systems. Ram's contributions to the field of electrical engineering are remarkable. As an architect and R&D manager at Kodak, he played a crucial role in the development of wireless film-cassette-sized digital radiography systems, which became a multi-million-dollar business. He also led the electronics/electrical team for a radiographic laser printer and contributed to the development of several other medical devices and systems, such as computed radiography systems, fetal heart monitors, and portable X-ray systems. Ram has kept his productivity high since leaving Kodak with his work on hand-cranked defibrillators for the Indian market and other analog electrical engineering work as a consultant. Ram holds 17 patents in various fields, including laser modulation, X-ray, hardcopy devices, digital and computed radiography, and defibrillators. He has published extensively and has been invited to present his work at numerous conferences and workshops. Furthermore, he is a Senior Member of IEEE, and active in various health and radiography professional societies.

Oral Presentations
ROTC - Classroom A

9:30 AM- 9:45 AM- Kayla Parsons, 803, Graduate Student, "Added Sugar Intake and Perceived Stress Negatively Predicts Body Image in College Students"

9:45 AM- 10:00 AM- Rakibul Hossain, 516, Graduate Student, "Synergistic effects of thermomechanical pulp fibers, cellulose nanofibrils, and surfactants in fabricating high-performance insulation foams: a structure-property relationship study"

10:00 AM- 10:15 AM- Solomon Agesi, 712, Graduate Student, "Effect of Environmental Policy Effectiveness on Industrialization in Developing Countries"

10:15 AM - 10:30 AM- Medha Bhattacharyya, 713, Graduate Student, "Foodways in Shani Mootoo's Fiction"

10:30 AM - 10:45 AM- Morgan Tallman, 714, Graduate Student, "Cognitive and Emotional Benefits of the Mindful Aging Memory (MAM) Skill Group: An Anonymous Focus Group Survey with Low Income Older Adults"

10:45 AM - 11:30 AM - BREAK

11:30 AM - 11:45 AM- Samantha Ireland, 607, Graduate Student, "The Modernist Use of The Theme of Lynching"

11:45 AM - 12:00 PM- Kyra Pederson, 721, Undergraduate Student, "Shoveling Sand: A Descent Into The Sinkhole— A Phenomenological Account of Grief Objects"

12:00 PM - 12:15 PM- Lunive Noel, 734, Undergraduate Student, "Problem of Knowledge Multilangual Learners Face"

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MAINE Student Symposium
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Oral Presentations
ROTC - Classroom B

9:30 AM- 9:45 AM- Jordan Miner, 501, Graduate Student, "Developing Integrin α2β1 Knockdown Cell Lines for 3D Breast Cancer Spheroid Migration Models"

9:45 AM- 10:00 AM- Johanna Holman, 1009, Graduate Student, "Steamed broccoli sprouts alleviate gut inflammation and retain gut microbiota against DSS-induced dysbiosis."

10:00 AM- 10:15 AM- Cassandra Rowan, 708, Graduate Student, "The Capacity of Adolescents to Consent to Mental Health Care"

10:15 AM - 10:30 AM- Sarah Turner, 911, Graduate Student, "Aquaculture and Aquatic Resources"

10:30 AM - 10:45 AM- Madeleine Nowak, 1004, Graduate Student, "Obesity and Changes in Adipose Gene Expression is Predicted by Circulating Hepatic Factors"

10:45 AM - 11:00 AM- Jennifer Thompson, 722, Graduate Student, "Sleep and Tauopathies: An Update of the Application of the PRISMA Method for a Systematic Review"

11:00 AM - 11:30 AM - BREAK

11:30 AM - 11:45 AM- Avery England, 124, Graduate Student, "Synthesis and characterization of sub-nanometer silver clusters formed by high-speed microfluidic turbine mixing"

11:45 AM - 12:00 PM- Cameron Barone, 608, Graduate Student, "The Legacy of Negritude in Cannibal"

12:00 PM - 12:15 PM- Elliott Hooper, 710, Graduate Student, "Removing Gender from Medicine: An Analysis of the Limitations Enforced by the Gender Binary in Pre-Medical Education"

12:15 PM - 12:30 PM- Sophia Claudio, 123, Undergraduate Student, "Investigation of the Relationship of Influenza A Virus Hemagglutinin (HA) and Phosphatidylinositol 4-Phosphate (PI4P) Using Fluorescence Photoactivation Localization Microscopy (FPALM)"

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Music Presentations
Minsky Recital Hall

9:15 AM- 9:30 AM- Chana Freedberg, 601, Undergraduate Student, “Selections from a Senior Recital in Vocal Performance”

9:30 AM- 9:45 AM- Samuel Ivey, 602, Undergraduate Student, “A Live Performance of Oskar Bohme's Trumpet Concerto in F Minor for Trumpet and Piano, Third Movement.”

9:45 AM- 10:00 AM- Ryan St. Peter, 603, Undergraduate Student, “Transposing for Flute Ensemble”

10:00 AM - 10:15 AM- Audrey Prentice, 604, Undergraduate Student, “Weber Grand Duo Concertant Mvt.3 Performance on Clarinet”

10:15 AM - 10:30 AM- Micah Thurston, 605, Undergraduate Student, “Camerata Dirigo”

Please join us after these performances to see more Graduate and Undergraduate work at the UMaine New Balance Fieldhouse

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UMSS24 Book of Abstracts

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- David Batuski

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106. Utilizing Crochet Hyperbolic Plane Models for Intuitive Learning

- Brenna Jones
- David Bradley

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- David Bradley

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- Eric Landis
- Reed Miller

580. Visualization of Structural Monitoring Data for the Penobscot Narrows Bridge

- Zachary Scott
- Andres Vargas
- Alexander Bourgoin
- Tyler Harwood
- Nicholas Dieffenbacher-Krall
- Laura Gurney

581. Unlocking the Cellulose Domain: A Methodological Framework for Ontology-Based Property Entity Construction

- Xuelian Zhang
- Torsten Hahmann

582. Characterizing Stability of Bulk Nanobubbles in Micro-gravity Using Dynamic Light Scattering

- Arman Kiani
- Ali Abedi

583. Wireless Propagation Models for Near Ground Antennas and investigating Penetrated signals through tree trunk

- Mersedeh Najishabahang
- Ali Abedi

584. Analysis of Hybrid Hydrogel Scaffolds for Post-bioprinting Density Variation of 3D-printed Chlorella Microalgae Cells

- Olubusuyi Ayowole

- Bashir Khoda

585. Multi-Fidelity Surrogate Modeling for Additive Manufacturing Applications

- Troy Zangle
- Masoud Rais-Rohani

586. Well-calibrated Uncertainty Quantification in Neural Networks for Barriers-based Robot Safety

- Masoud Ataei
- Vikas Dhiman

587. Sparse Hierarchical Representations for Fast Optimal Control

- Elvis Gyaase
- Vikas Dhiman

588. Omobot: A Low-cost Mobile Robot for Autonomous Search and Fall Detection

- Shihab Uddin Ahamad
- Masoud Ataei
- Vikas Dhiman
- Vijay Devabhaktuni

589. Nanocellulose Based Foams for Low-Cost Disposable Medical Applications

- Sydney Sheehan
- Dominic Kugell
- Michael Mason

Arts - Pgs.

601. Selections from a Senior Recital in Vocal Performance - 9:15 AM, Minsky Recital Hall

- Chana Freedberg
- Isaac Bray

602. A Live Performance of Oskar Bohme's Trumpet Concerto in F Minor for Trumpet and Piano, Third Movement - 9:30 AM, Minsky Recital Hall

- Samuel Ivey
- Jack Burt

603. Transposing for Flute Ensemble - 9:45 AM, Minsky Recital Hall

- Ryan St. Peter
- Elizabeth Downing

604. Weber Grand Duo Concertant Mvt.3 Performance on Clarinet - 10:00 AM, Minsky Recital Hall

- Audrey Prentice
- Beth Wiemann

605. Camerata Dirigo - 10:15 AM, Minsky Recital Hall

- Micah Thurston
- Laura Artesani

606. The Language of My Grandmother is a Language of Resistance: How the Matrilineal Transmission of Pisanki Expresses Cultural Identity

- Sarah Renée Oźlanski
- Carla Billiterri

607. The Modernist Use of The Theme of Lynching - Oral Presentation, 11:30 AM, Classroom A

- Samantha Ireland
- Carla Billitteri

608. The Legacy of Negritude in Cannibal - Oral Presentation, 11:45 AM, Classroom B

- Cameron Barone
- Carla Billitteri

Social Sciences and Humanities - Pgs.

701. Lifetime Trauma as a Risk Mechanism for Hazardous Cannabis Use in LGBTQIA+ Young Adults

- Leah Cingranelli
- Krutika Rathod
- Patricia A. Goodhines

702. Community-Led Alternatives to Jail Expansion and Exploring a Needs-Based Approach Considering Mainers With Connections to Penobscot County Jail

- Abigail Miller
- Sarah Walton

703. Teacher Perspectives Post Covid, Amidst Anti-Woke Policies

- Emily Hamby
- Rebecca Buchanan

704. Ensuring Representation of Diverse Perspectives in Maine's Climate Plan

- Louise Chaplin
- Catherine Mardosa
- Sharon Klein

705. The Contribution of Recovery Community Centers toward Substance Use Recovery Outcomes

- Cynthia Cushing
- Leslie Beliveau
- Maia Campoamor
- Elizabeth Hyde
- Jennifer Crittenden

706. Loneliness but Not Social Isolation Cross-sectionally Associated with Worse Cognitive Function in Older Adults During COVID-19

- Madison Landry
- Dylan Taplin
- Morgan Tallman

- Holly Timblin
- Rebecca MacAulay

707. Understanding the Socioeconomic Barriers Facing Precariously Housed and Unhoused People

- Brenna Jones
- Ryan LaRochelle

708. The Capacity of Adolescents to Consent to Mental Health Care - Oral Presentation, 10:00 AM, Classroom B

- Cassandra Rowan
- Patricia Goodhines

709. The Social Network Diversity Index for Emerging Adults - A Preliminary Analysis

- Kathleen Duncan
- Daniella Gelman
- Cynthia Erdley

710. Removing Gender from Medicine: An Analysis of the Limitations Enforced by the Gender Binary in Pre-Medical Education - Oral Presentation, 12:00 PM, Classroom B

- Elliott Hooper
- Lily Herakova

711. Human Trafficking on the Internet: A Social Work Obligation

- Sophie Ladd
- Elizabeth DePoy

712. Effect of Environmental Policy Effectiveness on Industrialization in Developing Countries - Oral Presentation, 10:00 AM, Classroom A

- Solomon Agbesi
- William Godfred Cantah

713. Foodways in Shani Mootoo's Fiction - Oral Presentation, 10:15 AM, Classroom A

- Medha Bhattacharyya

- Nathan Stormer
- Haley Schneider

714. Cognitive and Emotional Benefits of the Mindful Aging Memory (MAM) Skill Group: An Anonymous Focus Group Survey with Low Income Older Adults - Oral Presentation, 10:30 AM, Classroom A

- Morgan Tallman
- Madison Landry
- Holly Timblin
- Rebecca MacAulay

715. Associations Among Memory Performance, Aging, and Symptoms of Anxiety and Depression

- Jie Ning Zhu
- Michael Robbins

716. What Bridges the Gap Between Forgiveness and Suicidality? Examining Emotion Regulation and Interpersonal Needs as Serial Mediators

- Caroline Kelberman
- Eleanor Schuttenberg
- Autumn Chadburn
- Jennifer Blossom

717. Learning about Learning: Classroom Communication and Its Impacts on Students

- Hope Carroll
- Liliana Herakova

718. An Exploration of Factors Impacting the Associations Among Cognitive Performance, Education Level, And Depressive Symptoms

- Sean Carey
- Michael Robbins

719. Translating Poetry Books: Libro De La Tentación Y Del Olvido and Materia Oscura

- Chelsea Johanson
- Carlos Villacorta

720. Religious Self-Identity and Transphobia

- Sam Slavin
- Alexandria Morgan
- Sally B. Barker
- Kalina Chazin-Knox,
- Jordan LaBouff

721. Shoveling Sand: A Descent Into The Sinkhole— A Phenomenological Account of Grief Objects - Oral Presentation, 11:45 AM, Classroom A

- Kyra Pederson
- Kirsten Jacobson

722. Sleep and Tauopathies: An Update of the Application of the PRISMA Method for a Systematic Review - Oral Presentation, 10:45 AM, Classroom B

- Jennifer Thompson
- Sophia C. Lambert
- Jacob D. Tucker
- Fayeza S. Ahmed

723. Holy Alliances, Unholy Biases: Christian Nationalism's Role in Prejudice

- Alexandria Morgan
- Sally Barker
- Jordan LaBouff

724. Fast Friends

- Jenna Cox
- Sally Barker
- Jordan LaBouff

725. Sustaining Community and Identity through Food at the University of Maine

- Caty DuDevoir
- Daniel Sandweiss

726. Inclusive Representation in College Advertising: A Content Analysis of College Viewbooks

- Oliver May-Fleming

- Amelia Couture Bue

727. Engagement in Political Talk Among Student Members of Political Clubs on Campus

- Mariia Pugina
- Haley Schneider

728. Connectivity Through Social Media

- Joseph Gerhart
- Mary PlymaleLarlee

729. Examining the Longitudinal Effect of Social Network Size on Cognition During COVID-19

- Holly Timblin
- Taylor Maynard
- Morgan Tallman
- Madison Landry
- Rebecca MacAulay

730. Juveniles Who Sexually Offend: Does Victim Type Matter?

- Sophia Lambert
- Jeffrey Hecker

731. Challenging Counterfeit Diversity: A Content Analysis of College Admissions Viewbooks' Representation of Women in STEM

- Erika Hipsky
- Amelia Couture Bue

732. Coastline in a Changing Maine: The Economics of Coastal Preference

- Walter Lange
- Caroline Noblet

733. School Closures and Dropout Rates in Rural and Urban Areas of Ethiopia: Household-level Evidence From the HFP-HS Survey

- Abraham Tamru Assefa
- Kathleen Bell

734. Problem of Knowledge Multilangual Learners Face - Oral Presentation, 12:00 PM, Classroom A

- Lunive Noel
- Mary PlyMaleLarlee

735. Are Rural States Equipped For The Youth Mental Health Crisis?: An Investigation of The Mental Health Attitudes and Stigma Beliefs of Caregivers

- Benjamin Roseman
- Jennifer Blossom

736. Self-Efficacy is Associated with Self-Reported Health Status, but not to Physical Performance or Executive Functioning, in a Sample of Older Adults.

- Caroline Mosca
- Rebecca MacAulay

Natural Sciences - Pgs.

801. Characterizing englacial deformation the Eclipse Icefield (Yukon Territory, Canada)

- Emma Erwin
- Renée Clavette
- Inga Kindstedt
- Kailey Mannello
- Jake Holmes
- Seth Campbell

802. Surface Modification of Food Serving Containers using Lignocellulosic Materials under Gas Phase with Silanes as reactants

- Mamoona Raheem
- Viraji Senevirathne
- Mehdi Tajvidi
- Carl P. Tripp

803. Added Sugar Intake and Perceived Stress Negatively Predicts Body Image in College Students - Oral Presentation, 9:30 AM, Classroom A

- Kayla Parsons

- Kelley Strout
- Wenjun Zhou
- Jade McNamara

804. Investigating the Relationship Between Sea Surface Temperatures and Karenia Brevis in the Gulf of Maine using Environmental DNA and Remote Sensing Technology

- Hannah Kauffman
- Erin Grey

805. Using Song to Educate Children About the Ocean

- Alexandra Sousa
- William Ellis

806. Testing Heat Tolerance in Coral Zooxanthellae Symbiont Symbiodinium trenchii

- Savanna Deer
- Erin Grey

807. What Would it Take to Grow Glaciers on Mt. Washington?

- Jacob Pisani
- Alice Doughty

808. Assessing the Influence of Interseeded Cover Crops on Beneficial Arthropod Abundance in a Northeastern Agroecosystem

- Charles Cooper
- Rachel Schattman

809. Trends in Scientific Publications on the Ecology of Invasive Species Over Time

- Etain Cullen
- Andrei Alyokhin

810. Beyond the Shoreline: Investigating Gray Seal eDNA in Coastal Waters

- Jamie Fogg
- Julia Sunnarborg
- Christy Hudak

- Lisa Sette
- Kristina Cammen

811. The Energetics of Diurnal and Nocturnal Tropical Small Mammals

- Abe Grunwald
- Eric Brown
- Danielle Levesque

812. Immune Development and Immunocompetence of the Atlantic Sea Scallop (Placopecten magellanicus)

- Nichole Blackmer
- Jennifer Perry
- Brian Beal
- Timothy Bowden

813. Immune Gene Expression and Thymus Development as Indicators of Immunocompetence in Lumpfish, Cyclopterus lumpus L.

- Gabriella Peluso
- Ian Bricknell
- Timothy Bowden

814. Potential Invasive Species in Maine through a Horizon Scan Lens

- Robert Rowe
- Shehnaz Chowdhury
- Emma Irvine
- Nahida Kabir
- Shayli Morris
- Mariah Pearson
- Andrei Alyokhin

815. Processing Waste Reduction in the North Atlantic Squid Fishery: Quality Assessment of Squid Wing Byproduct Over 6-month Frozen Storage

- Mallory Perry
- Denise Skonberg

816. Dynamic Thinning and Velocity Fluctuations on Kaskawulsh Glacier

- Gavin Gleason
- Karl Kreutz

817. Developing a LAMP Assay to Identify Boghaunter Species in Southern Maine

- Cynthia Bellavance
- Erin Grey

818. Developing a LAMP Assay to Identify Blue-Spotted Salamanders in Maine

- Oluwadamilola Kolawole
- Erin Grey

819. Application of Ground Penetrating RADAR to Analyze Permafrost Structure

- Kavya Dayananth
- Karl Kreutz

820. A Comparison of Phytoplankton Abundance and Diversity in the Damariscotta River Estuary

- Maria Pagliaro
- David Townsend

821. Measurement of Freshwater Flux from Mendenhall Glacier

- Thomas Young
- Karl Kreutz

822. Investigating Environmental Change at Andy Lake

- Shannon Thompson
- Karl Kreutz

823. Yellowtail Kingfish Larval Immune Development

- Lingzi Ding
- Timothy Bowden

824. Evaluating The Effects Of Parasite Infections On Reproductive Potential In Maine Moose

- Isabella Costa
- Alaina Woods
- Pauline Kamath

825. Gelatin-glutaraldehyde-cellulose Nanofiber Based Biodegradable Packaging Films with Improved Barrier and Mechanical Properties

- Zhijing Zhan
- Jinwu Wang
- Ling Li
- Mehdi Tajvidi
- Denise Skonberg
- Qing Jin

826. The Use of Probiotics to Improve Survival in Atlantic Sea Scallop (Placopecten magellanicus) Larvae When Challenged with Pathogenic Vibrio Species

- Kyle Brennan
- Timothy Bowden

827. The Effects of Shear Stress on Sediment in an Erosion Chamber

- Grace Bauling
- Emanuel Boss

828. Establishing an Atlantic Salmon (Salmo salar L.) Primary Gill Cell Line for Advancing Research on Infectious Salmon Anemia Virus (ISAV) HPR0

- Daniel DeLap
- Sarah M Turner.
- Deborah Bouchard

829. The Effects of the 2023 Wildfires on Moose Habitat in Quebec

- Tristan McMerty
- Sabrina Morano

830. Evaluating Benthic Exchange of Methane and its Role in Greenhouse Gas Export From Intertidal Wetland

- Rachael Smith
- Jiaze Wang

831. Alaskan Permafrost Structure and Emissions in Disturbed and Undisturbed Locations

- Angelina Bucco
- Karl Kreutz
- Seth Campbell

832. Predation On Threatened Species: Diagnostic Bones To Inform Species Interactions

- Keiara Pham
- Jeremy D. Romer
- Kevin A. Stertz
- Christina Murphy

833. Development of a Field-Deployable Infrared-Based Method for Detection of BTEX Compounds in Water

- Graham McLaughlin
- Rihab Masmoudi
- Carl Tripp

834. The Impacts of Glacial Melt on the Herbert River and Eagle River

- Jenna Burke
- Karl Kreutz

835. The Movement of Nematocysts in the Sea Slug Berghia Stephanieae

- Emily Hartmann
- Ian Bricknell

836. Utilizing Retired Lobster Traps as Artificial Reefs: Mitigating Ghost Fishing Impacts and Enhancing Marine Conservation

- Deanna Gladstone
- William Ellis

837. Transformation of Diploid Potatoes Using the Marker RUBY

- Strix Kugler
- Han Tan

838. Subglacial Water Storage in a Temperate Glacier System, Southeast Alaska

- Renée Clavette
- Seth Campbell

839. Land Back Economics: A Sustainable Analysis of Hacienda Monarca

- Amelia Mooney
- Hayley Raab
- Diego Kulldorff
- Luis Perales
- Sharon Klein

840. Ocean Temperature Trends on the Scotian Slope spanning the past 11,000 years

- Devin Coffey
- Katherine Allen

841. Molecular and Electronic Microscopical Investigations of the Distribution of Cryptic Polydora onagawaensis species along the Coast of Maine

- Emma Tomasetti
- Paul Rawson

842. The Science of Compost: An Assessment of the Impact of Bacteria Isolated From Food Scrap Compost on Crop Plant Growth

- Nnamdi Baker
- Lindsey Bekele
- Elijah Burns
- Isabel Dionne
- Brooke Fifield
- Benjamin Flannery
- Patience Goulette
- Felicity Gregware
- Anna-Cate Kuver
- Sydney Roth
- Sydney Shair

- Tory Sweeney
- Jennifer Newell

843. BMB 210: Measuring the Effects of Isolated Bacteria from Food Scrap Compost on Tomato Plant Growth

- Keagan Rice
- Madison Alves
- Tyler Fultz
- Madison Goss
- Trevor Lowe
- Hayden Sargent
- Jennifer Newell

844. Iolite Data Reduction for LA-ICP-MS Use on Ice Core Samples

- Samantha Baumgartner
- Elena Korotkikh
- Michael Handley
- Paul Mayewski
- Andrei Kurbatov

845. The Relationship Between Extreme Precipitation And Stable Isotopic Values

- Muhammad Drammeh
- Karl Kruetz

846. Black Soldier Fly Larvae Meal as a Partial Protein Replacement in Formulated Larval Finfish Diets

- Meredith Ward
- Matt Hawkyard

847. Fermentation of Brewer's Spent Grain with Rhizopus Oligosporus.

- Adoum Fadaya Arabi
- Denise Skonberg

848. SKN-1 as a Regulator of Partridgeberry Extract Antioxidant Properties in C.elegans

- Daniel Joy
- Jennifer Newell- Caito

849. Antioxidant Algae: An Investigation into the Antioxidant Properties of Seaweed Through the Lens of Wabanaki Knowledge and History

- Emily Perilla
- Jennifer Newell-Caito

850. Quantifying the "Perfect Storm" for Sediment Entrainment at the Confluence of Nontidal Streams and Tidal Estuaries

- David Libby
- Bea Van Dam
- Sean Smith

851. Temporal and Spatial Precipitation Chemistry of Puerto Rico and US Virgin Islands

- Bez Warren
- Amanda Olsen
- Thomas Korstanje
- Jody Potter
- Bill McDowell
- Amanda Olsen

852. An Anionic Exchange Resin Can Sequester Perfluorooctane Sulfonic Acid (PFOS) under in Vitro Ruminal Conditions

- Sarah Benner
- Kizito Nishimwe
- Ana Paula Jimenez Lagos
- Andre Mindiola Mendoza
- Lilian Nowak
- Juan Romero

853. Evaluating Native Bog Birch for Horticultural Production in a Changing Climate

- Jessica Hutchinson
- Stephanie Burnett
- Bryan J. Peterson

854. Assessing Maine's Bird Species in Relation to Forestry Practices

- Ethan MacKenzie
- Sabrina Morano

855. Chemical Gradients and the Mobility of Major and Trace Elements in Weathering Rinds of Serpentinites

- Gwenivere Watkins
- Amanda Albright Olsen

856. Species Diversity, Resilience, and Sustainability in Aquaculture: A Review of the Literature

- Sebastian Crapa
- Neil Greenberg

857. Quantifying IgM Response in Atlantic Salmon

- Josephine Oarr
- Sarah Turner

858. Investigating the Effects of Soil and Plant Characteristics on Soil-to-Plant PFOS Transfer Factors in Perennial Forage Systems Across Maine

- Sonora Ortiz
- Jean MacRae
- Thomas Simones
- Andrew Smith
- Ellen Mallory

859. Protective Effects of Winterberry (Ilex Verticillata) on Caenorhabditis Elegans with Manganese-Induced Toxicity

- Leah Mastrianno
- Jennifer Newell Caito

860. Trust in Science and Institutions Among Residents of Maine

- Melissa Godin
- Charity Zimmerman
- Caroline Noblet

861. Effects of a Caddisfly Range Shift on Competition and Facilitation in High Elevation Ponds

- Ava Ardito
- Hamish Greig

862. Reading Between the Hydrograph Lines: Analyzing Measured Flows to Inform Penobscot River Restoration

- R. Cade King
- Bea E. Van Dam
- Sean M.C. Smith

863. Optimum Nitrogen Management In Organic Dry Bean Direct Seeded Into Roll Crimped Cereal Rye Mulch

- Madeline Hunter
- Mathew Ryan
- Heather Darby
- Tom Molloy
- Sarah Pethybridge
- Erin Silva
- Ellen Mallory

864. Genesis of Antimony Deposits in Carmel, Maine, USA

- Eyan Fennelly
- Martin Yates

865. Development of an Innovative Whey Protein Recovery Process Utilizing Seaweed Extracts

- Alex Pierce
- Qing Jin

866. Comparing the Feeding Selectivity of Larval Lobster Stages on Calanus finmarchicus though rtPCR

- Tessa McCarthy
- Richard Wahle

867. Establishing Chronologies for the Outlet Glaciers of the Juneau and Kluane Icefields, Western North America

- George Swenson
- Aaron Putnam

868. Bonaire: A Beacon of Positive Change in a Shifting Climate

- Nicholas Cavalieri
- Robert Steneck

869. Expression of Heat Shock Protein 20 in a Stressed Soft Coral, Anthelia glauca

- Carly Balfe
- Ian Bricknell

870. The Current State of Global Coral Reef Restoration Efforts

- Collin Cooper
- Neil Greenberg

871. Effect Of Topography On The Size Of Colombian Glaciers

- Ethan Sherman
- Alice Doughty

872. Investigating Bacillus velezensis BAC03 for Controlling Soilborne Diseases of Potato and Improving Soil Health

- Mandana Askarizadeh
- Jianjun Hao

873. Frequency and Likelihood of Glacial Lake Outburst Floods in Juneau Alaska

- Anthony Mazzola
- Karl Kreutz

874. Fungal Diversity Variance in Response to Human Disturbance

- Brady Kaelin
- Peter Avis

875. Mass Transfer effects on Benthic Macroalgae in Central Long Island Sound

- Collin Beirne
- David Townsend

876. Development and Application of an Environmental RNA Assay for Detecting Spawning Activity in Atlantic Cod (Gadus morhua)

- Lucia Liet
- Graham Sherwood
- Amber Garber
- Aaron Whitman
- Erin Grey

877. The Effects of Microplastics on Coral Reefs

- Isabella Levine
- Teresa Johnson

Interdisciplinary Research - Pgs.

901. SustainaVerse: A VR Experience Exploring the Impact of Climate Change through Decision-Making & Sustainability Awareness

- Hannah Milne
- Ersilda Cako
- Richard Corey

902. Gauging Human Trust Through the Use of a Multimodal, Omnidirectional, and Immersive Autonomous Vehicle Simulator

- Adam Elkadi
- Nicholas Giudice

903. Exploring The Impacts Of Gendered Anthropomorphized Artificial Intelligence On User Trust In Fully Autonomous Vehicles

- Rachel Coombs
- Paul Fink

904. Communicating Resilience: Innovative Rural Municipal Digital Communication

- Adeline Stone

- Elle Prescott
- Dean Syed
- Carter Frank
- Jasmine Lopez
- Emma Olney
- Keeli Parker
- Jessica Leahy
- Kathleen Bell

905. Fostering Community Resilience: Learning From Maine's Municipal Governments

- Ruth Griffith
- Chloë Sheahan
- Kaitlyn MacPhee
- Kyle Pellerin
- Jessica Leahy
- Kathleen Bell

906. The Unhoused Population’s Use of Public Parks and Lands and Gear Accessibility in Maine

- Corinne Couch
- Jessica Leahy

907. The Economic Impact of Off-Highway Vehicles

- Dalton Kelly
- Jessica Leahy

908. Evaluating Environmental Education with Non-Readers

- Laini Frager
- Jessica Leahy

909. Influencing Factors of Landowner Allowance for ATV Trails: A comprehensive Literature Review and Research Proposal

- Gabriella Binette
- Jessica Leahy

910. Social Barriers to Recreation in the Outdoors

- Nathan Lavoy

- Jessica Leahy

911. Cellulose Nanomaterials: A Novel Adjuvant and Delivery System for Aquaculture Vaccine Applications - Oral Presentation, 10:15 AM, Classroom B

- Sarah Turner
- Blake Turner
- Kora Kukk
- Jacob Holbrook
- Michael Mason
- Deborah Bouchard

912. Moving on Snowflakes and Melting Ice: Jumping, Glandular-landing and Meniscus-climbing Abilities of Snow Springtails

- Richard Viveiros
- Victor Ortega-Jimenez

913. Bioluminescence as a Sustainable Alternative for Lighting on Trails, in Parks, and Other Urban Areas

- Sam Barrett
- Jessica Leahy

914. The Correlation of Best Management Practices Between Forestry as well as Parks, Recreation, and Tourism

- Liam Bradley
- Jessica Leahy

915. Sustainable Energy Initiatives within Underserved Communities: A Review of Social Network Analyses

- Jasmine Lamb
- Faizan Saif
- Sharon Klein

916. The Effects of Third Places on Rural Communities in Maine

- Eleanor Prescott
- Jessica Leahy

917. The Science of Compost: An Assessment of the Efficacy of Ungrading, Sense of Belonging, Self-Directed Learning, and Growth Mindset in an Undergraduate Research Learning Experience

- Sydney Shair
- Keagan Rice
- Jennifer Newell

918. The Role of State Networks in Advancing Community-initiated-and-engaged Sustainable Energy Action in Underserved Communities Across the United States

- Janine Siqueira Borges
- Sonia Leone
- Caroline Noblet
- Sharon Klein

919. Reducing Loneliness for Maine's Aging Population through Social Outreach

- Kathryn Davison
- Elliott Hooper
- Sean Carey
- Thomas Lemay
- Ben Morgan
- Ali Abedi

920. Towards Generalized Speech Separation for Hearing Aids: Deep Learning approach for combined Music and Speech

- Tristan Zippert
- Terry S Yoo

Biomedical Sciences - Pgs.

1001. Early Life Broccoli Sprout Consumption Confers Stronger Protection Against Enterocolitis in an Immunological Mouse Model of Inflammatory Bowel Disease

- Lola Holcomb
- Johanna Holman
- Sue Ishaq

1002. A Zebrafish Model Demonstrating that DPM3 Functions in Both Dystroglycan Dependent and Independent Roles in Neuromuscular Disease Progression

- Amanda Ignacz
- Claire Schaffer
- Mary Astumian
- Clarissa Henry

1003. Investigating the Role of KRAB Zinc Finger Proteins (KZFPs) in Mitigating Non-syndromic Cleft Lip and Palate (CLP) in A/WySn Mice

- Arad Bustan
- Kehinde Adeniran
- Haley Fortin
- Christopher Baker

1004. Obesity and Changes in Adipose Gene Expression is Predicted by Circulating Hepatic Factors - Oral Presentation, 10:30 AM, Classroom B

- Madeleine Nowak
- Rea Anunciado-Koza
- Robert Koza

1005. JC Polyomavirus Infection Requires β-arrestin in Primary Kidney Cells

- Sophie Craig
- Melissa Maginnis

1006. Investigating the Role of Inflammatory Signaling in Adult Zebrafish Kidney Regeneration

- Olajuyin Olaleye
- Heiko Schenk
- William Sampson
- Iain Drummond

1007. Investigating the Role of b4gat1 as a Facilitator of Axon Guidance and Muscle Development

- Kodey Silknitter
- McHenna Martin
- Mia Corradi
- Benjamin King
- Clarissa Henry

1008. Progression Predicament: Issues With Measuring Progression in Primary Open Angle Glaucoma

- Rajat Rai
- Giovanna Guidoboni

1009. Steamed Broccoli Sprouts Alleviate Gut Inflammation and Retain Gut Microbiota Against DSS-induced Dysbiosis - Oral Presentation, 9:45 AM, Classroom B

- Johanna Holman
- Lola Holcomb
- Sue Ishaq

1010. Tissue-Clearing and Molecular Labeling of Early Axolotl Developmental Stages

- Samuel Broadbent
- Marko Pende
- Prayag Murawala

1011. Deciphering P. aeruginosa Mechanisms Causing Increased Drug Efficacy Against C. albicans

- Trizzie Ha
- Allie Conner
- Robert Wheeler

1012. Modeling Acute Kidney Injury Following Influenza Virus Infection Using Zebrafish

- Jessica Walsh
- Brandy-Lee Soos
- Benjamin King

1013. Can Zebrafish be Used to Model Human Chronic Granulomatous Disease?

- Katie Stevens
- Robert Wheeler

1014. Inferring Fosl1a Transcriptional Targets Following Influenza A Virus Infection

- Benjamin Vetelino
- Brandy Soos
- Benjamin King

1015. Mechanisms of Cetylpyridinium Chloride Inhibition of Immune Cell Function: Unraveling CPC Effects on Tyrosine Phosphorylation Events

- Sydni Plummer
- Jeongwon Eom
- Bright Obeng
- Morgan Tasker
- Julie Gosse

1016. Determining Essential Genes Contributing to the Regulation of the Mitochondrial Unfolded Protein Response (UPRmt)

- Seth Ashby
- Suzanne Angeli

1017. Antioxidant Effects of Yarrow Flower Extract in C. elegans

- Allison Weymouth
- Jennifer Newell-Caito

1018. The Effect of Antimicrobial Treatment on Co-infections of Candida albicans and Group B streptococcus

- Griffin Lawrence
- Melody Neely

1019. Construction of Zebrafish Myosin Essential Light Chain mutants

- Mason Soares
- Tayo Adekeye
- Jared Austin
- Jared Talbot

1020. Characterizing the Multi-System Impacts of crppa-Associated Dystroglycanopathy

- Mia Corradi
- Clarissa Henry

1021. NLRP3 Inflammasome Activation and the Inflammatory Response Following Influenza A Virus Infection

- Sarah MacLeod

- Brandy-Lee Soos
- Benjamin King

1022. Microbial Modulation of Neuroinflammation and Amyloid-Beta Aggregation in Alzheimer's Disease through the Gut-Brain Axis: Implications for AD Patients with Gut Dysbiosis

- Saba Ho-Rezvani
- Leonard Kass

1023. Impact of Prophage-Driven Regulation of mppA on Bacterial Fitness in Group B Streptococcus

- Dominic Needham
- Caitlin Wiafe-Kwakye
- Melody Neely

1024. Analyzing Drug Targeting Effects on Cluster Patterning of Serotonin Receptors during JC Polyomavirus Infection

- Lucas Bennett
- David Winski
- Samuel Hess
- Melissa Maginnis

1025. Using Hybridization Chain Reaction (HCR) to Investigate Migratory Muscle Formation in Zebrafish

- Angelina White
- Jared Talbot

1026. The Role of Flotillin in Prophage-driven whiB7 Expression and Antibiotic Resistance in Non-tuberculous Mycobacteria

- Ashley Howes
- Hector Orellana
- Sarah McCallister
- Hilda Frempong
- Sally Molloy

1027. A Collaboration with the Phage Genomics Course to Isolate and Characterize Novel Bacteriophage that Infect Pathogenic Mycobacteria

- Amy Hardy
- Alison Kueck
- Sally Molloy

1028. Zebrafish Compensate for Impaired Fast-twitch Muscle Activity by Increasing Slower Movements

- Troy Hupper
- Dmitrii Krivorotko
- Jared Austin
- Tayo Adekeye
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101. Simulations of Supernovae from Red Supergiant Progenitors

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Peter Manzella

Faculty Mentor: David Batuski

Abstract: A red supergiant star typically ends its existence when the star's core collapses, resulting in a supernova explosion. We study this process, from the starting point of collapse, to the point when densities become great enough for 'core bounce' to start the star-destroying shock wave, using computer simulations. Using the simulation code, FLASH, various parameters of the star were analyzed in the context of core collapse. A series of profiles of density, radial velocity, shock position, and several other parameters were created. 50 models were simulated based on progenitor stars that were evolved with rotation. The models spanned the range 16.0 to 25.8 Solar masses in 0.2 Solar mass increments. Each of these models produced a successful core bounce, but were unable to propel the shock wave throughout the star, a 'failed supernova'. This failure can be observed by looking at a plot of the shock position, as well as the radial velocity at late times. The shortest of the bounce times from 16.0 to 25 solar masses was 205 milliseconds, and the longest was 308 milliseconds.

102. Fractional Dimension Avalanches in Magnetic Nanostructures

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Andrii Obertas

Faculty Mentor: Nicholas Bingham

Abstract: Artificial spin ice is defined as an array of single-domain nanoscale magnetic islands that can have two different orientations of the south and north poles, or magnetic moments. Due to the presence of geometrical defects, the individual island moments flip in an avalanche-like fashion when subjected to external stimuli (e.g., elevated temperatures and magnetic fields). One-dimensional avalanches in artificial spin ice are relatively well studied, as they are the most energetically favorable to occur. In this study, we utilized micromagnetic simulations (MuMax3), capable of solving Landau-Lifshitz equations, to investigate various geometrical layouts of the magnetic islands that result in two or fractional dimensional avalanche propagation. We achieved this by introducing defects to the array by changing the relative position and volume of individual islands in the lattice. The resulting models are processed using the image recognition model. The convolutional neural network Detectron2 was trained to detect islands and their magnetic moments using the training set of simulated images. The effects of the defects in the array are studied to elucidate the physical phenomena determining the dimensionality of the avalanche spread. The results from this project will be extended for the development of predictive models on chaotic behaviors of macroscopic avalanches.

103. Transition Metal Doping in $BaTiO_3$

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Ethan Cronk, Daniel Wilson

Faculty Mentor: Nicholas Bingham

Abstract: In the study of perovskites (ABX_3 crystal structure), we seek to understand what properties arise under intense configurational disorder. This disorder caused by muti-element doping is fast-growing and remarkably complex. Therefore, by doping on the B site of $BaTiO_3$ with 3d transition metals similar to Ti in charge, we anticipate further structure distortion and thus property alteration at a high degree. $BaTiO_3$, well-known for its potential applications in ferro-/piezoelectricity, and commonly used in composite multiferroic materials, can be distorted in its perovskite structure when doped. This allows for tunability of compound stoichiometry and can lead to dramatic changes in the physical properties of the material. Thus, by choosing to dope on the B-site, we expect to see how a variety of 3d transition metals incite structural changes and possibly property-based tuning. In our work, our research group working within FIRST and the thin film synthesis and characterization lab, successfully created and built a functioning magnetron sputtering chamber to synthesize these perovskites. With this device we can create $BaTiO_3$ films (layered on top of $SrTiO_3$ and Si) and then attempt to co-dope the $BaTiO_3$ with Co, Ni, Mn, and Fe. Utilizing characterization devices within our lab like X-ray Diffraction (XRD) and X-ray Photoelectron Spectroscopy (XPS) as well as Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS) within FIRST, we can determine the quality of our films as well as the potential properties they can have. Where the results can encourage future work in tuning the properties of $BaTiO_3$.

104. Exploring Early-Universe Magnetism: Modeling Magnetic Monopoles with Artificial Spin Ice

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Sarah Rogers-Pastio

Faculty Mentor: Nicholas Bingham

Abstract: Theories in cosmology propose that magnetic monopoles may have existed abundantly in the beginning of the universe. Magnetic monopoles are described as “magnetic charges” with a single north or south pole, as opposed to normal magnets which have both. The trouble for cosmologists is that true magnetic monopoles have never been discovered. Cosmologists have used digital simulations to model the monopoles. In contrast to the digital simulations method, this project proposes a new, physical method of modeling these early-universe magnets. In this project, we explore the potential of using nanoscale magnetic lattices called artificial spin ice (ASI), which are 2D arrays of mesoscopic magnetic islands with user-defined geometries, to model the magnetic monopoles that cosmological theories propose. In this research, we designed an ASI lattice for monopole generation, synthesized ASI material, and employed magnetic force microscopy (MFM) for verification and early-universe monopole modeling. Utilizing both square and Kagome ASI lattices, we externally apply magnetic fields to control individual island moment orientations. Upon application of sufficiently high magnetic fields, all island moments align parallel to the field. To reset the array, we utilize three demagnetization techniques (thermal annealing, gradual reduction of AC magnetic fields, and mechanical perturbations) to reset the array to the initial conditions. By comparing the outcomes of these demagnetization methods, we can elucidate their distinct impacts on both the macroscopic behavior of ASI and the microscopic behavior of magnetic monopoles. Such findings provide insights that extend beyond ASI dynamics and are applicable to bulk materials.

105. Untangling the Out of Distribution Dilemma

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Rhiannon Gould

Faculty Mentor: David Bradley

Abstract: In statistical learning theory learning paradigms are based on the assumption that both the training and test data are both independently and identically distributed. However, this assumption may not always hold when the training and the test data fall from different distributions due to many factors, including data collection from different sources. This causes the statistical models to be vulnerable to data distribution shifts under the domain adaptation (DA) phenomenon which creates an out of distribution (OOD) problem. In the real world, the OOD problem causes degradation in the performance and could lead to an incorrect task decision. This becomes a concern when accuracy is pertinent such as in healthcare applications or autonomous vehicles.

This project looks to discover what causes the distribution shifts such as temporal or spatial evolution of data and even sample selection bias inherent in the data collection process. There are additional difficulties such as defining when it means for data to be OOD and once defined, how to detect and manage OOD data to reduce its impact and create more robust models. These topics will be explored both theoretically and through experiments conducted on image datasets.

106. Utilizing Crochet Hyperbolic Plane Models for Intuitive Learning

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Brenna Jones

Faculty Mentor: David Bradley

Abstract: Hyperbolic Geometry, diverging from the more familiar terrain of Euclidean Geometry, poses significant challenges in visualization due to its deviation from everyday experiences. As a consequence, comprehending hyperbolic properties, particularly following the acquisition of Euclidean principles, presents a formidable task for students. Addressing this pedagogical hurdle, mathematicians have explored various modeling techniques, predominantly employing paper-based constructs. However, these endeavors often entail arduous assembly processes and yield fragile models, thereby restricting hands-on learning opportunities. The utilization of crochet as a modeling medium, pioneered by Dr. Daina Taimina in 2001, offers a breakthrough in crafting durable, manipulable hyperbolic plane models conducive to interactive learning environments. This paper delineates various hyperbolic geometry properties facilitated by crochet hyperbolic plane models, alongside methods for integrating these models into classrooms to cultivate intuitive learning experiences.

107. Demystifying Monte Carlo Simulations and The Curse of Dimensionality

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Aleksandar Opacic

Faculty Mentor: David Bradley

Abstract: This capstone project aims to create an educational framework for effectively understanding Monte Carlo simulations and the curse of dimensionality. Monte Carlo simulations, named after the famed Monaco gambling resort, are a class of computational algorithms that rely on repeated random sampling to obtain numerical results, which are crucial in fields from finance to physics, while the curse of dimensionality describes the complexities that arise with high-dimensional data. The capstone will explore the theoretical underpinnings of Monte Carlo simulations, delving into their historical development, mathematical basis, and practical applications. It will also examine the curse of dimensionality in-depth, discussing its implications in fields such as data analysis, machine learning, and computational complexity. This term was coined by Richard Bellman—we will see it becomes a significant challenge. This idea refers to various problems that come to light when analyzing and organizing high-dimensional spaces that do not occur in low-dimensional settings. An interactive learning module with visual aids, real-world examples, and simulations will be developed to simplify these advanced topics for diverse learners. The project's success will be meeting the goal of making these complex mathematical concepts more accessible and engaging.

108. Financial Derivatives and Other Risk Management Tools

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Drew Goodwin

Faculty Mentor: David Bradley

Abstract: Since the advent of trade, individuals and all sizes of groups have used it to manage risk. The vast category of financial derivatives is one approach to doing so, and their application for risk management is called "hedging." Consider a contract (known as a forward contract) between a corn farmer and a food producer. The food producer will need 1 million bushels of corn in 1 month. They arrange a deal wherein the farmer will provide 1 million bushels of corn for 4 million US dollars. For the farmer, this trade will be a winner if the price of a bushel of corn is below $4 one month from now. For the food producer, the opposite is true. Though one party will "lose," both may desire reduced exposure to potential corn price volatility. Broadly, a derivative is an asset whose value depends on the value of an "underlying" asset. Futures contracts and stock options are the most common exchange-traded financial derivatives, therefore their applications and valuation are the primary focus of this piece. Active, liquid markets for an asset enable trading among parties with more profit-driven motives. For all parties, it is imperative that accurate pricing models exist for derivatives, otherwise fair pricing cannot be set for hedgers and the counterparties who assume risks hedgers seek to avoid. The following piece explores generally accepted pricing methods for various derivatives, in increasing complexity, as well as some interesting applications and alternative approaches.

109. An Introduction The Pythagorean Win-Loss Theorem in Sports

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Aileen Campbell

Faculty Mentor: David Bradley

Abstract: The Moneyball theory has become widely known within baseball, and outside the realm of sports thanks to the 2003 film starring Brad Pitt. The theory is the most popular known example of sabermetrics, the application of statistical analysis to baseball-related data. Known as the father of sabermetrics, statistician and writer Bill James coined the term in 1980, and began to popularize his findings and theories. Another theory of James's is known as the Pythagorean Win-Loss Theorem (also referred to as pythagorean expectation or pythagorean winning percentage). The theorem serves to predict the number of games in which a team "should" win based on their runs scored and runs allowed. It is often used during the MLB season to see if a team is over-performing or under-performing and then predict how the rest of their season will unfold. In my work, I will provide a derivation of the formula based on the work of other sabermetricians. The theorem has been updated over the years to provide a more accurate model, which I will also delve into. Lastly, I will explore how the theorem can be used to create similar models for other sports such as hockey or basketball. In connecting statistics with mainstream sports such as baseball, I hope that the theories and use of statistics become much more appealing and understandable to a wider audience.

110. Understanding Fibonomial Coefficients

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Zachary Delile

Faculty Mentor: David Bradley

Abstract: Binomial coefficients are a common occurrence throughout mathematics. Whether it be within binomial expansions in algebra or binomial distributions in probability theory, their unique properties make them overwhelmingly relevant in many real-world computations. Because of their "nice" properties, mathematicians have put much effort into finding more generalized analogues of binomial coefficients. One such analogue, the Fibonomial coefficient, can be derived using sequences generated by Lucas polynomials. As the name implies, Fibonomial coefficients utilize the famous Fibonacci sequence while maintaining the form and properties of binomial coefficients. Despite their abstract nature, these coefficients have notable applications in combinatorics. In particular, Fibonomial coefficients combine the binomial coefficient's ability to count lattice paths in the coordinate plane with the ability of Fibonacci numbers to count tilings of strips with squares and dominoes. In this project, I first introduce the Fibonomial coefficient before providing the necessary background on lattice paths, tilings, and Fibonacci numbers. Next, I present several combinatorial interpretations found by mathematicians in the past two decades. More specifically, I explain several counting problems enumerated by Fibonomial coefficients. I close this project by introducing several identities of Fibonomial coefficients that maintain the same form as binomial coefficients. Finding a combinatorial proof of many of these identities is an open problem in combinatorics, and I aim to pose some direction to solve this problem.

111. Interactive Theorem Provers for Undergraduate Mathematics

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Oliver May-Fleming

Faculty Mentor: David Bradley

Abstract: Interactive Theorem Provers (ITPs), or proof assistants, are systems that assist in the rigorous verification of mathematical proofs. Using formally defined systems of logic, they offer a step-by-step way to increase the confidence we have in mathematical results. These provers have the potential for mathematics education at all levels. For undergraduate students, ITPs can solidify foundational proof techniques and provide a framework for working with more challenging concepts by encouraging precise reasoning and exposing potential contradictions. The rise of ITPs is mirrored by their increasing use in research, where they can help verify complex theorems and improve the peer-review process by limiting human error. This project focuses specifically on Lean 4, a powerful theorem prover and programming language built upon the foundations of its predecessor, Lean 3. Lean 4 offers some advantages over many other proof assistants due to its emphasis on extensibility, performance, and a developing mathematical library (mathlib4). This project particularly focuses on the undergraduate-level section of mathlib4, seeking to describe room for expansion in its capabilities. By carefully analyzing existing content, as well as looking at current applications of the language, the goal is to pinpoint gaps in coverage and identify areas where Lean 4 could be strengthened as a comprehensive tool for undergraduate-level mathematics.

112. The Braess Paradox

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Kayla Burns

Faculty Mentor: David Bradley

Abstract: The Braess Paradox is a fascinating phenomenon in network theory. It's a counterintuitive observation about the behavior of road traffic networks. The paradox states that adding a new road may result in an increase of time for travelers, and that closing a road may result in decrease of time for travelers. This concept was discovered by Dietrich Braess in 1968 and this paper will explore its origins, as well as its fundamental principles and applications in various scientific fields.

113. Modern Approaches to Gaussian Process Regression

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Joseph Godinez

Faculty Mentor: David Bradley

Abstract: Nonparametric statistical methods use mathematics to produce robust models of random variables without explicit distributions. A Bayesian nonparametric stochastic process known as the Gaussian process (GP) takes any finite number of such random variables and attributes them to one joint Gaussian distribution. While powerful, technological applications of GP have proven to be computationally expensive. A recent framework constructed by (Katzfuss 2021) is based on a method for estimating models on continuous spatial processes introduced by (Vecchia 1998). This results in much greater efficiency when constructing statistical computer experiments using large datasets. Additional methods using similar techniques have been proposed, each incorporating modifications to increase process flexibility. This work aims to analyze the definition and mathematical structure of the traditional Gaussian process and compare its accuracy and computational efficiency to modern approximated approaches including (Guinness et al. 2021), (Sauer et al. 2023), and (Zilber 2021). Mathematical proof and data visualization using computer software will aid this comparison. Finally, future directions for GP implementation will be discussed.

114. Exploring Voronoi Diagrams: Mathematical Foundations and Applications

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Ethan Waterhouse

Faculty Mentor: David Bradley

Abstract: Understanding and utilizing spatial relationships between data points is fundamental in math and science, particularly in data analysis. A powerful method for representing and exploring these spatial relationships is the Voronoi diagram. A Voronoi diagram is a division of space into regions based on proximity to a given set of data points, where each region corresponds to the subset of space closest to a particular data point. This project details the mathematical foundations of Voronoi diagrams in a variety of contexts, examining details about their useful properties, construction, computation, and generalizations. In particular, we highlight the minimizing properties of centroidal Voronoi diagrams and their application to statistical algorithms for unsupervised learning and data clustering.

115. A Useful Factorization of Poincaré Polynomials

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Kaia De Vries

Faculty Mentor: Gilbert Moss

Abstract: Orthogonal transformations are an interesting area of study. Since such transformations are made up of reflections and rotations, we can gain knowledge of these transformations by considering them in the context of finite groups. If we restrict ourselves to considering only transformations generated by reflections, we can study these transformations in the context of Coxeter groups. Such groups consist of a set of generators and relations and are an abstraction of reflection groups. Restricting ourselves to this space will allow us to construct an alternating sum formula to compute the determinant of a transformation contained in our group.

A sequence can be constructed to examine the growth of such groups described above in relation to their generating sets. From this sequence, Poincaré polynomials are constructed which have useful applications in homology theory. The derived alternating sum formula for determinants gives rise to a useful factorization of Poincaré polynomials.

1**16.** Imaging Magnetic Monopoles in Brickwork Artificial Spin Ice

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Rachel Fister

Faculty Mentor: Nicholas Bingham

Abstract: Although the existence of magnetic monopoles remains unproven, they can be produced physically on the microscopic scale through a lattice of magnets. Artificial spin ice (ASI) can be used to predict the behavior of these theoretical monopoles. ASI are nanoscale magnetic lattices that experience geometrical frustration. They can be produced lithographically into a variety of 2D patterns that are user-defined. My project involved synthesizing ASI samples and analyzing their magnetic properties through various imaging techniques. To begin, I used a computer simulation called mumax3 to create potential ASI lattice structures. This software predicts the magnetic properties of my ASI designs based on the magnitude and direction of an applied magnetic field. A brickwork ASI structure was chosen and synthesized in the laboratory using electron beam lithography. This method produces ASI samples in an arrangement of nanometer islands patterned into a ferromagnetic film. After creating the ASI sample, we analyzed it by using Magnetic Force Microscopy (MFM) to determine the individual magnetic moment orientation at each island. This is accomplished by measuring the deflection of a magnetic tip due to the magnetic force it experiences as it passes over the ASI sample. With this information we described the local magnetic field distributions throughout the lattice. As a result, by using MFM imaging we were able to recognize magnetic monopole-like structures in the brickwork lattice.

117. Variation of the Magnetostriction of Ferromagnetic Transition Metal Thin Films with Different Growth Conditions

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Kalani Perera, Morton Greenslit, Mauricio Pereira da Cunha

Faculty Mentor: Nicholas Bingham

Abstract: Magnetostrictive materials undergo reversible changes in shape and dimensions upon magnetization, as the reorientation of magnetic domains within the material occurs in response to an external magnetic field. Hence, magnetostrictive thin films are used in a wide variety of applications such as sensing, transduction, energy harvesting, biomedical imaging, microelectronics, and beyond due to their desirable properties such as easy fabrication, low cost, tunability, small-size and high sensitivity compared to their bulk material counterparts. Ferromagnetic transition metal (e.g. Ni, Co, Fe) thin films and later electrodes that are used for the transduction in the fabricated Surface Acoustic Wave (SAW) device are grown using e-beam evaporation and magnetron sputtering under different growth conditions such as substrate temperatures, growth rates, film thickness, material composition, and a variety of substrates to optimize the magnetostriction and the related properties in a useful way. Magnetic field-dependent X-ray diffraction (XRD) is used to investigate the crystallographic variations in magnetostrictive films due to the external magnetic field. Lastly, we will discuss the fabrication of a magnetic field sensor based on SAW that alters the SAW propagation properties in the presence of external magnetic fields as a result of the variations of magnetostriction and its accompanying properties such as the changes in elastic modulus (Δ-E effect), and magnetic anisotropy.

This work was supported by DOE awards DE SC00201981.

Keywords –Magnetostriction, External magnetic field, Ferromagnetic materials

118. Photo Active Architecture with Graphene Nanoribbons (GNR) Using Porphyrin-Based Antenna Systems

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Anjana Meegasmullage

Faculty Mentor: Tomas Marangoni

Abstract: The ability to harvest energy from the sun has become one of the most important scientific challenges of the last decade. Many different approaches have been developed, and carbon nanomaterials have taken a predominant position. This is due to their unique electronic properties, which enable fast and precise charge separation upon activation of photoactive units. However, most nanomaterials (e.g., carbon nanotubes, carbon nanodots, graphene, etc.) are plagued by structural inhomogeneity, which strongly hampers reproducibility and precision from one study to another, as well as the development of higher-order architectures. Here we present our novel approach to generate carbon-based photo active architecture which is based on conjugation between Porphyrin & atomically precise GNRs. These GNRs are obtained through bottom-up approach based on polymerization sequence, which enables a precise structure with low number of defects. In our project we are using GNR as a template for the construction of carbon-based photo active architecture.

119. Synthesis of Sequence-Defined Peptoids to Form Two-Dimensional Nanosheets for the Hydrophobic Cargo Encapsulation

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Hettikankanamge Kalani Samarasekara

Faculty Mentor: Alessia Battigelli

Abstract: Peptoids are a novel class of bio inspired, sequence defined peptidomimetic polymers. They are composed of repeating N-substituted glycine monomer units where the hydrophilic/hydrophobic side chains are attached to the N atom instead of alpha carbon, as in peptides. Peptoids can be synthesized by solid phase synthesis using a sub-monomer protocol which allows the incorporation of a wide range of monomers with a very high yield. The absence of the amide proton makes them extremely resistant to proteolysis and other chemical/physical denaturants. As a consequence, self-assembled peptoids are promising materials for the design of drug delivery systems and in particular for cancer therapy. Amphiphilic peptoid sequence of 28 residues characterized by defined sequence of alternating polar and nonpolar residues are reported to self-assemble into highly stable, free-floating two-dimensional nanosheets in water. In this work, we synthesize a sequence-defined peptoid, form nanosheets and explore their potential to encapsulate hydrophobic cargo such as a chemotherapy drug (Doxorubicin). The ultimate objective of this study is to investigate the ability of the synthesized peptoid nanosheets to encapsulate chemotherapy drugs and act as biocompatible nanocarriers that can be successfully employed in cancer therapy.

120. Simulating the Effects of Binary Companions on Core-Collapse Supernovae

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Andrew Teller

Faculty Mentor: Neil Comins

Abstract: In 2009, astronomers first detected luminosity spikes seen in the early stages of supernovae. These brightness fluctuations ended before reaching threshold brightnesses predicted by existing supernova models. These events have since been dubbed "failed supernovae" and are believed to occur when high-mass supergiant stars (greater than 18 times the mass of our Sun (i.e., 18 $M_{\odot}$)) collapse directly into neutron stars or black holes before a rebound shock off their cores can occur and initiate a full-blown supernova. Current simulations in general relativity exploring this phenomenon are based on two-dimensional, axisymmetric metrics for the collapsing star. These calculations often neglect the effects of a companion star on the collapse process of the star that is expected to undergo a supernova. Binary star systems make up more than half of all star systems in the Milky Way. By simulating the failed supernova events in three dimensions with the Einstein Toolkit software platform, we apply the effects of an 18 $M_{\odot}$ binary companion to the evolution of a 20 $M_{\odot}$ star undergoing collapse. Our simulations were run with a variety of initial stellar separations and angular momenta. We track the entropy, energy density, and pressure of the primary star throughout the collapse period. The effects of tidal forces, Roche lobe overflow, and turbulence are included as potentially deterring factors to the generation of an expanding neutrino-driven shock front, which is the mechanism that drives a supernova. While all the runs to date have led to supernovae of the 20 $M_{\odot}$ star, we continue to explore these parameters in the hope of generating stalled core-collapse scenarios.

121. Asteroid Projection in Virtual Reality

Submission Type: Exhibit

Submission Category: Physical and Mathematical Sciences

Author(s): Aleigha Morgan

Faculty Mentor: Richard Corey

Abstract: The Asteroid Projection in Virtual Reality project aims to revolutionize astronomy education by leveraging immersive technology. Traditional teaching methods often struggle to convey the dynamic nature of celestial phenomena, hindering student comprehension. To address this, the project adopts a multidisciplinary approach, integrating astronomy, physics, and virtual reality. Through meticulous research, fundamental concepts are revisited, NASA's asteroid data is analyzed, and experts are consulted. Leveraging Unreal Engine, an immersive VR environment is constructed for users to explore asteroid trajectories. Preliminary findings, supported by a study by Liu et al. (2020), demonstrate that immersive VR significantly enhances student engagement and comprehension. Initial user testing of the project also shows promising results, with participants expressing increased interest and understanding. In conclusion, the project represents a pioneering effort to bridge the gap between abstract astronomical concepts and student comprehension, aiming to revolutionize science education.

122. Modeling Planet Formation in the Protoplanetary Disk of the DQ Tau System

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Ryan Corzo

Faculty Mentor: David Batuski

Abstract: The study of Exoplanets has been an area of great interest in recent years. The first exoplanet was discovered in 1992, and since then over 5000 confirmed exoplanets have been discovered and cataloged. However, even with our broadening understanding of exoplanet systems, pivotal questions remain unanswered. Namely, what are the mechanisms behind planet formation within binary star systems? When a protostar forms, a spinning disk of dust and gas called a protoplanetary disk, is left behind. Within this disk, small particles of dust and gas collide, forming and growing as clumps, providing the ideal environment for planet formation. This project aims to investigate planet formation within the protoplanetary disk of the exoplanet system DQ Tau. The DQ Tau system contains two binary stars, each with a mass of 60% of that of the Sun. The disk surrounding the stars is estimated to have a diameter of 33.6 times Earth's distance from the Sun and a mass of 1% of the Sun's mass. Using previously determined disk parameters from Atacama Large Millimeter/submillimeter Array observations, and the REBOUND N-Body integrator, this research constructs the protoplanetary disk surrounding the binary stars at the center of DQ Tau in the Python environment and models the particle collisions within this disk that give rise to simulated planets. By modeling particle collisions within the disk, this study aims to investigate key factors influencing planet formation, including the mass, size, and orbital characteristics of resultant planets and the presence of residual disk material.

123. Investigation of the Relationship of Influenza A Virus Hemagglutinin (HA) and Phosphatidylinositol 4-Phosphate (PI4P) Using Fluorescence Photoactivation Localization Microscopy (FPALM)

Submission Type: Oral Presentation - 12:15 PM, Classroom B

Submission Category: Physical and Mathematical Sciences

Author(s): Sophia Claudio

Faculty Mentor: Samuel Hess

Abstract: Influenza A virus (IAV) is a harrowing contagious disease that causes fever, sore throat, and body aches, and is common during the months of December through March. The virus fuses to a host cell using its binding membrane glycoprotein Hemagglutinin (HA) and its cytoplasmic tail domain (CTD) that is made up of 9-10 amino acids. HA colocalizes and clusters with phosphatidylinositol 4,5-biphosphate (PIP2), which is a lipid on the cellular plasma membrane used in important cell signaling pathways, molecular trafficking, and the regulation of ion channels. Phosphatidylinositol 4-phosphate (PI4P) is used to synthesize PIP2. Although the mechanism between the interaction is unknown, we hypothesize that HA with PI4P will have similar clustering and density patterns to HA with PIP2 due to the electronic factors dependent on the amount of negatively charged phosphate.

In this experiment, the interaction between HA and PI4P is imaged using Fluorescence Photoactivation Localization Microscopy (FPALM) by tagging HA and PI4P molecules in NIH3T3 cells with photoactivatable proteins Dendra2 and PAmCherry1-P4C. So far, images have shown significant co-clustering of HA with PI4P, and individual clustering of PI4P. Analysis on the colocalizations includes radial distribution functions and cluster identification. Imaging a mutation of HA-CTD, HAREMAY, with PI4P was also performed to test the mechanism of action. It is hypothesized that if we discover an interaction that impairs and decreases the clustering and density of HA in a host cell, the knowledge could be used to develop a better vaccine in order to prevent and control the spread of IAV. More research should be done on medications targeting this interaction.

124. Synthesis and Characterization of Sub-nanometer Silver Clusters Formed by High- speed Microfluidic Turbine Mixing

Submission Type: Oral Presentation - 11:30 AM, Classroom B

Submission Category: Physical and Mathematical Sciences

Author(s): Avery England, Rosemary Smith

Faculty Mentor: Scott Collins

Abstract: Noble metal nanoparticles have grown an increasing amount of attention due to their novel chemical and physical properties. These properties depend highly on the number of atoms in the nanoparticle and can be tuned by varying the size. For example, as the size of a nanoparticle approaches the fermi wavelength of an electron, typically below 2nm, the confinement of charges alters the electronic band structure, allowing a tunable band gap that can be adjusted by nanoparticle size. The theory of size-dependent quantum effects has been known for a considerable amount of time but until recently only few people believed in its potential for practical use. Today, researchers are harnessing these size-dependent properties for potential applications such as single-electron transistors, solar cells, LEDs, microscopy, medical imaging, and quantum computing. Unfortunately, silver clusters of 13 atoms or less (ie. ≤ 0.7 nm) are metastable using current synthesis techniques. These clusters quickly aggregate (within 1 ms) to more thermodynamically stable Ag nanoparticles (5 nm – 10 nm), making silver clusters capable of quantum size effects challenging to obtain. Using a novel high-speed rotary turbine micromixer, we present a simple synthetic protocol to form stable silver clusters (0.5 nm – 1.2 nm). The turbine, operating at rotational velocities of >20k rpm, enables reagents to be mixed within 50 – 100 µs to form nanoclusters that are stable for at least 60 days.

125. Synthesis of Sequence-defined Peptoid based Hydrogel for Biomedical Applications

Submission Type: Poster

Submission Category: Physical and Mathematical Sciences

Author(s): Nuraia Afreen

Faculty Mentor: Alessia Battigelli

Abstract: Hydrogels are three dimensional polymeric networks able to retain a large quantity of water. Due to their similarity in structure to the extracellular matrix, they have been applied in a wide array of biomedical applications, with particular interest in stem cell therapy, as they can be used as scaffold for cells. In this project, we are investigating the use of peptoids as polymeric building blocks for the development of biocompatible hydrogels for stem cell therapy. Peptoids are peptidomimetic polymers composed of repeating N-substituted glycine monomers. Their sequence defined structure, ease of synthesis and proteolytic stability make them an ideal candidate for biomedical applications. With the aim to use them as a scaffold for stem cells, we are synthesizing a library of peptoids characterized by functional groups able to crosslink covalently or non-covalently multiple peptoid chains, acting as gelation agents. Varying the type and the amounts of functional groups on the polymer chains, the effect on the mechanical properties of the resulting material will be investigated, ultimately, comparing peptoid hydrogel properties with the ones of commonly used hydrogel-forming polymers.

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201. Development of a Structured Query Language Database: A Statistical Analysis of the Effects of Increased Tourism on Acadia National Park and the Outdoor Recreation Economy

Submission Type: Poster

Submission Category: Business

Author(s): Jaymie Pratl

Faculty Mentor: Tanya Beaulieu

Abstract: Acadia National Park stands among the top ten most visited National Parks, drawing over 3.97 million tourists annually [1]. The surge of tourists has led to a notable increase in foot and vehicle traffic through the park, with an additional 210,000 more vehicles in the past year alone [2]. In response to the environmental challenges posed by the increased tourism, volunteer programs like Friends of Acadia actively engage in park maintenance and data management. The annual reports generated by this program have been organized into a Structured Query Language (SQL) database. This database serves as the foundation for a statistical analysis, displaying the ecological impact on the park over the last five years. The analysis serves to guide strategic solutions for ensuring the sustainable preservation of the park and economic vitality.

[1] U.S. Department of the Interior. (n.d.). Tourism to Acadia National Park contributed $479 million to local economy in 2022. National Parks Service. https://www.nps.gov/acad/learn/news/20230830.htm

[2] U.S. Department of the Interior. (n.d.-d). Transportation plan. National Parks Service. https://www.nps.gov/acad/learn/management/transportation-plan.htm

202. Agritourism Information Framework: An Analysis of U.S. States

Submission Type: Poster

Submission Category: Business

Author(s): Caroline Paras

Faculty Mentor: Erin Percival Carter

Abstract: “If it isn't on Google, it doesn't exist.” How do farmers and fishermen find information on agritourism? How do consumers and visitors discover agritourism experiences that meet their availability and interests? The pandemic forced much training and other supporting materials online, where governmental and non-governmental entity websites now aim to serve as effective repositories of information available to all thanks to growing access to high speed broadband. The increase in both computer and internet access not only broadens the ways in which farmers and fishermen gain access to information, they also broaden the universe of “experts” to professionals in other disciplines, such as small business development and tourism promotion. States can play an important leadership role in agritourism development, particularly in curating information. To determine how U.S. states are providing producers with information on agritourism, we evaluated multiple state-level websites in every U.S. state according to 11 constructs targeting five primary audiences: industry, producers, communities, local consumers, and visitors. Recognizing that outreach, training, and technical assistance take many forms, we developed indicators that account for a wide array of information modes, such as discussion groups, training, publications, websites, search portals, special events, and access to experts, particularly for topics in high demand from producers. This research offers insight into strategies used by states that appear to be performing relatively well in supporting and promoting agritourism online and a vision of an ideal integrated digital agritourism support program.

203. Urban Influence of America's Largest Metropolitan Areas on US Counties: Evidence from Econometric Connectedness

Submission Type: Poster

Submission Category: Business

Author(s): Johnson Oliyide, Oluwasegun Babatunde Adekoya, Richard Afatsao, Todd Gabe

Faculty Mentor: Thomas Wiesen

Abstract: The objective of this paper is to examine the econometric connectedness of US counties relative to the country's largest metropolitan areas. To measure urban influence, we utilize the concept of econometric connectedness which is commonly used to measure market integration in finance and macroeconomics. Using Bureau of Labor Statistics monthly employment figures for all counties from 1990 to the present, separate vector autoregressive (VAR) models are estimated, which include New York, Los Angeles, Chicago, a county of interest, and control variables. We then use joint conditioning sets and the novel joint forecast error variance decomposition to extract the percent of the forecast error variance of a US county's economic activity explained by the shocks of the metropolitan areas included in the model. This measure of econometric connectedness quantifies how influential the metropolitan areas are in explaining the economic activity of US counties, and it generates a continuous urban influence score between zero and 100% for each county. A second version of the analysis measures urban influence relative to the nine largest US metropolitan areas.

The econometric connectedness results show a wide variation in the urban influence of US counties ranging from places with urban influence scores of close to zero to counties with scores approaching 90%. The paper's main policy implication is that it provides a new measure of urban influence to complement the urban influence codes of the US Department of Agriculture (USDA), which places US counties in one of twelve discrete categories based on their population size and proximity to an urban area.

204. Current Challenges Facing Maine's Natural Animal Fiber Industry: A Producer Focus

Submission Type: Poster

Submission Category: Business

Author(s): Mikayla Reynolds

Faculty Mentor: Stephanie Welcomer

Abstract: This research project was designed to better understand the animal fiber sector in Maine, particularly focused on investigating the experience of Maine fiber producers and processors. Findings from this study illuminated several core challenges faced by fiber producers, specifically, as well as challenges facing other fiber actors and the fiber sector at large. Fiber producers raise animals that produce fiber, such as sheep, alpacas, rabbits, and goats. This fiber is harvested for use in making fibergoods, including yarn, apparel, blankets, and other value-added crafts.

27 fiber producers were interviewed as part of this study, where 15 raised sheep, 4 raised alpacas, 4 raised rabbits, 3 raised both sheep and goats, and 1 raised both sheep and alpacas. Of these 27, over a third were visited a second time to share preliminary findings and discuss their representativeness and accuracy to ensure outcomes aligned with lived realities and the sector.

When asked about key challenges facing the sector, clear themes emerged in producer responses. Challenges can be categorized into three domains: educating consumers, infrastructure support, and financial viability. Each of these identified themes highlights areas where fiber producers feel solutions and practical actions must be prioritized in order to sustain the work they are doing and to better support the fiber sector in Maine. The impact and outcome of this project is that organizations, policymakers, and practitioners in Maine and beyond can recognize the domains of most need and respond to these to support creating a more sustainable fiber industry.

205. Passenger Rail in Maine: Exploring Potential Economic and Environmental Impacts

Submission Type: Poster

Submission Category: Business

Author(s): Myles Harrison

Faculty Mentor: Stefano Tijerina

Abstract: Maine, a state that's known for its beautiful landscapes and coast, has seen a lot of modes of transportation. While the state runs on a dependable highway system and an airline network, the presence of passenger rail services has remained relatively limited. However, as the demand for sustainable and efficient public transportation options continues to grow, there is an interest in implementing passenger rail in Maine. I would like to investigate the future of passenger rail in Maine and its potential environmental and economic impacts. The purpose of this research is to investigate whether passenger rail is a beneficial and feasible alternative to cars, buses, and other modes of transportation.

As a student, combining my finance, economics, and Maine interests, I am excited to take on this challenge of researching the feasibility of passenger rail transportation to quantify if the resulting research can potentially shed light on how passenger rail can be a sustainable alternative to current transportation.

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301. Where Are the Girls? A Content Analysis of the Top 30 Box Office Children's Fiction Movies

Submission Type: Poster

Submission Category: Education

Author(s): Taylor Richardson, Emma Gold, Eleanor Buskey, Genesis Madu

Faculty Mentor: Sandra L. Caron

Abstract: This study examined the inclusion of girls and women in children’s movies. Several studies have discussed children’s movies and the prominent role of boys and men in films. This study involved a content analysis of children's fiction movies to determine what female characters are found in children's movies and what role they play in the storylines of these movies. Specifically, we analyzed how female characters are portrayed in a sample of 30 top box-office children's movies between the years 1994-2023. As the highest-grossing children’s movies, these are the films viewed by the largest audience and received the most attention from viewers. We sought to examine how female characters are portrayed in the most popular films. We coded female characters as playing either a major, secondary, or minor role, based on how often they were seen within the trailers, as well as their place in the cast list from the synopsis. Additional analyses examined the female character’s role in the film, her position within a family unit, whether she had a love interest, as well as her race, and appearance/body size.

302. Adoption Option: A Content Analysis of Adoption Agency Websites

Submission Type: Poster

Submission Category: Education

Author(s): Caroline Wheeler, Hailey Andrews

Faculty Mentor: Sandra Caron

Abstract: The National Council for Adoption (NCA) is the leading resource on adoption issues in the United States, providing an online directory of agencies for those interested in adoption. The purpose of our study was to conduct a content analysis of adoption agency websites listed by NCA to see what information is readily available for those individuals or couples interested in adopting. Our research focused on 20 randomly selected adoption agency websites obtained from their directory. We examined the content provided by each adoption agency's website for similarities and common themes. We identified common themes, such as information on pregnancy services for those making an adoption plan, cost of adoption, application information, foster care services, and countries that agencies work with for international adoptions. Based on our analysis, we were able to "paint a picture" of what someone interested in adopting would find on an adoption agency's website. Our findings and a discussion of implications will be presented.

303. The Impact of Shooter Attacks at U.S. School: An Analysis of Gun Legislation Introduced Following School Shootings

Submission Type: Poster

Submission Category: Education

Author(s): Ashley Cray, Carleigh DeMarco, Abigail Lynch, Brianna Russo

Faculty Mentor: Sandra Caron

Abstract: Gun violence is a public health crisis in America. More than 110 people are killed every single day by gun violence, and at least 200 more are wounded. Firearms are now the number one cause of death for children in the United States, surpassing motor vehicle deaths and deaths by all other injuries. The United States is an outlier when compared to other developed countries in both its gun death and injury rate and with gun safety regulations. The Columbine High School Shooting, April 20, 1999, is often referred to as the beginning of the school shooting epidemic. School shootings draw attention and discussion about gun policy and legislation. Groups such as “Moms Demand Action” say most Americans favor Common Sense Gun Reform including background checks on all gun sales, red flag laws, secure storage, waiting periods on gun sales, and limits on high-capacity magazines. Our research involved examining what happened in those states after the 12 largest school shootings in U.S. history. We researched the state’s legislative actions that were introduced following each school shooting. Patterns and themes of legislation introduced following each school shooting were identified. In addition, those bills were further examined to determine which ones were successful or unsuccessful in passing and becoming law. Our findings and a discussion of implications will be presented.

304. Examining the Incidence of Suicide Attempts in Maine: Comparing the Availability of Mental Health Resources by County

Submission Type: Poster

Submission Category: Education

Author(s): Emily Labbe, Miranda Gibbons, Olivia Hoovler

Faculty Mentor: Sandra Caron

Abstract: Our research project was designed to investigate the rate of suicide attempts in Maine by county and compare this rate to the number of available mental health services in each county (i.e., psychiatrists and psychologists; targeted case management agencies). We wanted to know if a county had a higher rate of suicide attempts, did it have fewer mental health services? Maine grapples with one of the highest rates of suicide deaths (involving firearms), despite Maine being among the top five states in the U.S. for mental health resources. According to the CDC, Maine's rate of suicide is 19.5 per 100,000, ranking it very high - number 15 - in suicide mortality in the United States. Our research project sought to understand where the need for additional funding for mental health services is greatest in Maine by looking at the data in the previous year by county: suicide attempts vs mental health resources. Our study looked at each county in Maine. We examined the percentage of attempted suicides in each county in 2022 and compared it with the percentage of licensed psychiatrists and psychologists in each county, as well as the percentage of targeted case management agencies for mental health in each county. Our findings and a discussion of implications will be presented.

305. Banning Banned Books: Case Studies of Efforts Against Book Challenges and Bans Across the U.S from 2022 to 2023

Submission Type: Poster

Submission Category: Education

Author(s): Elisabeth Landry, Joseph Parent, Katelynn Fortier

Faculty Mentor: Sandra Caron

Abstract: In recent years, book challenges and subsequent book bans have steadily increased across the United States. The number of challenged books reported to the American Library Association in 2021 was higher than in the 20 years they've been documenting attempted bans. While data was still being collected for 2023, according to ALA there has been a 20% increase in the number of unique titles being challenged just from January 1, 2023, to August 31, 2023. A total of 1,915 books have been challenged during this period. Our research focused on identifying specific examples or case studies of efforts against the banning and challenging of books. We searched the Internet to find examples of groups or communities fighting back against proposed book bans across the United States. We used search terms such as "fighting banned books," "preventing the banning of books," "defending rights to read books" and "opposing book banning." We were interested in finding out where these efforts were taking place and where there had been success in banning the banning of books. Our findings and a discussion of implications will be presented.

306. Sexuality Education in Central Maine High Schools: What's Happening Now and What's Changed in Two Decades

Submission Type: Poster

Submission Category: Education

Author(s): Morgan Inman

Faculty Mentor: Sandra Caron

Abstract: The purpose of this study was to examine sexuality education practices in Central Maine high schools. To do so, interviews were conducted with teachers in those area schools who are responsible for sex education classes. The interviews focused on teacher training, their goals in teaching sex education, the topics they cover, and any other sex education-related activities the school offers. Furthermore, the information obtained from these teacher interviews was compared to the findings of a similar study involving interviews with Central Maine teachers completed in 2000 by a previous UM Honors student. The current study provides a better understanding of the current state of sexuality education programs in these high schools, as well as an understanding of change over time. The findings and a discussion of implications will be presented.

307. The Ongoing Battle for Sexual Education in the U.S.: A Content Analysis of Policies and Legislation Introduced in 2023

Submission Type: Poster

Submission Category: Education

Author(s): Jacob Tuiasosopo, Ana Dunn, Cindy Miller

Faculty Mentor: Sandra Caron

Abstract: Our study examined current legislation that has been introduced and passed in states across the U.S. related to sex education. While there is broad support for sex education, many young people are not receiving it. According to the Sex Information and Education Council of the United States (SIECUS, 2023), only 29 states require some form of sex education. Thirty states require sex education to emphasize abstinence, and 16 states require abstinence-only education. Only five states require that sex education be comprehensive. Only 17 states require that the information related to sexuality be medically accurate. Even though almost every state has some guidelines on how and when sex education should be taught, decisions are often left up to individual school districts, resulting in inconsistent policies. What has happened in communities across the country is that a small, vocal group of people have introduced policies and legislation challenging the teaching of sex education. Our research study involved a content analysis of such policies and legislation introduced in all 50 states and the District of Columbia in 2023. The SIECUS website served as our source for this analysis. It monitors what policies and legislation are introduced in each state each year. We looked for common themes to determine what topics have been raised by these policies and legislative actions as they relate to sex education in schools. Our findings and a discussion of implications will be presented.

308. ReMo API

Submission Type: Poster

Submission Category: Education

Author(s): Michael Lally, Anthony Attaya-Harris, Tyler Walker, Nicholas Tassinari, Ayan Tariq

Faculty Mentor: Laura Gurney

Abstract: The world is increasingly online, and the field of education is no different. As a result, LiteracyTech is creating an online service to assist teachers in keeping track of their local libraries. In this project, we provide an Application Programmable Interface (API) to facilitate the usage of this platform as an intermediary between the database and the user. The API will support intelligent searching, to include all parameters of a book (ISBN, author, publisher, series, etc) as well as allowing users to filter down their query to get more precise results. This project will allow LiteracyTech to better serve schools and make more reading accessible to all. This API will also provide a way to interact with the LiteracyTech database in JSON format, a widely-supported way to structure information. With this, it would be trivial to build more apps/products supporting schools by reading from this API. A large focus of our project is speed, since past solutions in this field have suffered greatly from the performance needed to support so many concurrent schools/students at once. We are also using MongoDB as the database, which scales well with wide, concurrent usage where more traditional databases do not. In short, this project aims to assist educators and learners alike in sharing the world of reading.

309. Increasing Access to Aquaculture Using Virtual Tour Technology

Submission Type: Poster

Submission Category: Education

Author(s): Jennifer Navarrete

Faculty Mentor: Scarlett Tudor

Abstract: This project is about making an animation explaining the life cycle of one of our animals in our touch tank at CCAR, specifically the lobster. The purpose of doing this is to teach the younger generation about lobsters and their life cycle and how important it is and to inspire the younger generation to care and know the importance of lobster and how it is also crucial for the lobster fishery here in maine. How I am doing this project is all through powerpoint and I am drawing and animating the pieces together and making it fun but also informative so that the kids can both enjoy while being educated on the topic. And how I am doing the animation is by drawing on whatever I want to add in and then I can make it move to the direction I want it to move in powerpoint. It is a mix of cartoon and realism in the animation and it teaches on every detail of the lobster life cycle and how it is also being affected through climate change based on the temperature of the ocean. There is also an activity that I am working on along with this project for kids to do in school. The activity is about having 4 pictures of animals in our touch tank in different phylums and what the kids would do is based on observation of what animals belong in which phylum. And the pictures would be handed out to the kids so they can start the activity and teach them in the process how some of these species are important for aquaculture and how they benefit the ocean ecosystem.

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401. Effectiveness of Objective Structured Clinical Examinations and Standardized Patient Simulations for Increasing Learner Knowledge in Family Nurse Practitioner Education: A Systematic Review of the Literature

Submission Type: Poster

Submission Category: Allied Health

Author(s): Sean Sibley, Jennifer Bonnet

Faculty Mentor: Kelley Strout

Abstract: Aim: The aim of this systematic review was to evaluate the effectiveness of increasing knowledge and skill competency using OSCEs and standardized patient simulation in Family Nurse Practitioner education. The study was registered in PROSPERO (ID: 374393)

Background: Many programs use OSCE and SP simulation but there is limited empirical data demonstrating its effectiveness on Kirkpatrik's level of learning.

Methods: A systematic search of published and unpublished literature of all time was conducted in seven databases/registries in February 2023. Quantitative experimental studies with a comparison and explicit FNP learner population were included.

Results: Out of 4442 records, zero studies met the inclusion criteria. Some studies with eligible designs investigated different populations (e.g., acute care nurse practitioner, pre-licensure nursing).

Conclusion: The absence of included studies in this systematic review upholds the established need for continued investigation and can be used to support funding opportunities addressing this gap in nursing education science.

402. Traumatic Brain Injury in College Students: Exploring Associations Between Social-emotional Functioning and Fatigue

Submission Type: Poster

Submission Category: Allied Health

Author(s): Lydia Bradfield

Faculty Mentor: Jessica Riccardi

Abstract: A traumatic brain injury (TBI) of any severity during childhood and early adulthood can cause persistent, long-term challenges (CDC, 2018). Recent research has shown that children and young adults who experience a TBI present with difficulties in higher-level cognitive, physical, and social-emotional functioning (Ciccia et al., 2021; DiBattista et al., 2014; Riccardi et al., 2020). However, there is little research investigating social-emotional health and cognitive and physical symptoms, such as fatigue, after mild TBI based on gender and age. The research study aims to understand the relationship between mild TBI, social-emotional health, and fatigue based on gender and age for children and college students. This study will use data from an online, self-reported survey to explore these relationships.

403. Exploring Adverse Childhood Experiences in Children with Brain Injury

Submission Type: Poster

Submission Category: Allied Health

Author(s): Molly Hale

Faculty Mentor: Jessica Riccardi

Abstract: The overall purpose of this research is to investigate the relationships between childhood brain injury, adverse childhood experiences (ACEs), overall health, and life participation for children under twelve years old. This project will include a secondary analysis of data from the 2020-2021 National Survey of Children's Health on children under 12 years old (about 60,000 children). Multiple linear regressions, moderation analyses, and cluster analysis were used to identify the relationship between ACEs, brain injury, and outcomes (e.g., health, participation), and potential protective factors (e.g., older age, insured status). The results of this study could help health and educational professionals better identify children at risk for negative outcomes (e.g., those with ACEs and childhood brain injury) and encourage early provision of related supports and services (e.g., speech-language therapy, referral to community services).

404. Exploring the Needs of Caregivers of and Professionals working with Children with Brain Injury in Maine

Submission Type: Poster

Submission Category: Allied Health

Author(s): Elizabeth Walker

Faculty Mentor: Jessica Riccardi

Abstract: Acquired brain injury (ABI) is the leading cause of disability in children. In Maine, over 2,000 children experience an ABI annually. Children with an ABI of any severity often present with chronic health needs across domains that might not emerge until years post-injury. Yet, most medical and educational systems, including Maine's, do not have pathways of care to ensure appropriate identification and monitoring of long-term needs for children with ABI. Given best-practice guidelines, establishing a system to support children with TBI long-term, including connecting them to local services to address their health and educational needs, would likely improve outcomes for Maine's children. The primary goal of this project is to conduct a needs assessment to identify, understand, and prioritize the needs of children with acquired brain injury in Maine. This poster will describe the results of a confidential online survey self-administered by caregivers of and professionals serving children with ABI. Recruitment is ongoing with 20 surveys completed to date. Data will be presented to describe the areas of need that caregivers and professionals perceive could be improved to better support children with brain injury, such as early intervention, educational, and health services. Patterns will be examined based on sociodemographic data, including identifying as part of or serving rural communities and/or historically marginalized groups. The results of this survey will inform the development of a long-term monitoring system for children with ABI in Maine.

405. Development and Pilot of an App-Based Ecological Momentary Assessment of Fatigue

Submission Type: Poster

Submission Category: Allied Health

Author(s): Sophie Dean, Raymond Perry

Faculty Mentor: Jessica Riccardi

Abstract: Fatigue is one of the most persistent and disabling symptoms after childhood traumatic brain injury (TBI), yet few effective assessment strategies exist relevant to clinical practice. Therefore, fatigue often goes unaddressed or untreated, contributing to reduced academic and social participation and quality of life after childhood TBI. The purpose of this research project was to develop and pilot an app-based ecological momentary assessment of fatigue for children with TBI. This presentation will include a description of the development of an app-based assessment of fatigue and preliminary results of pilot the app in individuals without TBI. The results of this project will inform future studies that pilot the app in children with TBI and investigate the daily and diurnal frequency of fatigue after TBI.

406. Hyperbaric Oxygen Therapy for Cancer Patients with Radiation-Induced Tissue Injuries

Submission Type: Poster

Submission Category: Allied Health

Author(s): Daniel Weaver, Jasmine French, Abby Roy, Julia Shannon

Faculty Mentor: Valerie Herbert

Abstract: Cancer, secondary to cardiovascular disease, is the leading cause of death worldwide (Centers for Disease Control and Prevention, n.d.). Radiation is a standard cancer therapy; however it can cause fibrosis of blood vessels, the breakdown of soft tissue, and subsequently lead to necrosis. When caring for cancer patients, it is imperative to consider the lasting effects interventions pose on their long-term health. Hyperbaric oxygen therapy (HBOT) is a healing treatment consisting of administering 100% oxygen to the body in a pressurized chamber; in turn, HBOT facilitates capillary regrowth, blood flow restoration, and increased efficiency of wound healing time. The efficacy of hyperbaric oxygen therapy in improving the healing time of radiation-induced tissue injury in adults, compared to those not receiving the therapy, was examined. A literature search was conducted using the databases CINAHL and PubMed. The search encompassed the years 2019 to 2024 and included the search terms: hyperbaric oxygen therapy, injury, radiation, and cancer. Inclusion criteria involved articles that identified the uses of HBOT when treating post-radiation injuries for breast, head, neck, and pelvic cancers. Exclusion criteria included articles that did not fit the age group or highlighted alternative treatment modalities. Twelve peer-reviewed articles met the search criteria. The literature found that individuals receiving HBOT for radiation-induced complications reported increased quality of life, decreased pain, and minimal side effects shortly after therapy. Based on the findings, there is strong support that this treatment modality can reduce the healing time of tissue injuries compared to those not utilizing HBOT.

407. Implications of Mentor Education use in Dedicated Education Unit clinical models correlation to satisfaction levels

Submission Type: Poster

Submission Category: Allied Health

Author(s): Maggie Menter

Faculty Mentor: Valerie Herbert

Abstract: The project focuses on implementing preceptor education for those within the dedicated education unit clinical model and its correlation to increased student and preceptor satisfaction. Implementing Dedicated Education Units (DEU) aims to increase satisfaction within the learning environment, thus creating greater student engagement in the clinical experience. Nursing students who participated in the DEU model report positive learning experiences, increased self-confidence, supportive learning environments, teamwork and communication, and decreased cognitive loads and stress levels after participating in the DEU clinical experience. It is essential to have preceptors who have been well-prepared to involve students in the care they are providing while meeting students' learning needs. A literature search utilizing relevant keywords was conducted, focused on nursing education, limiting articles from 2019-current. Providing effective education to nursing preceptors provides essential skills to be utilized during the DEU model, such as providing feedback, setting goals, therapeutic communication, and critical thinking. Nurse preceptors who receive adequate training are better equipped to serve as competent preceptors, improving satisfaction for students as well as preceptors.

Keywords: dedicated education unit, mentor/preceptor education, preceptor/student satisfaction

408. Ozempic (semaglutide) versus Nonpharmacologic Interventions For Weight Management in Overweight Individuals

Submission Type: Poster

Submission Category: Allied Health

Author(s): Emma DiGirolamo, Emily Kane, Callie Gilmore, Elena Jacey, Lily Jennings

Faculty Mentor: Valerie Herbert

Abstract: Ozempic (semaglutide) is a medication prescribed for individuals managing Type 2 Diabetes Mellitus by mimicking the action of a hormone called GLP-1, helping to regulate glucose levels by stimulating insulin secretion and reducing glucagon secretion. Many patients with Type 2 Diabetes Mellitus rely on Ozempic (semaglutide) as a weight loss aid as opposed to implementing healthy lifestyle changes. This information proposes the question: in overweight individuals taking Ozempic (semaglutide), a medication prescribed for those with Type 2 Diabetes Mellitus, for the management of weight loss, does the use of Ozempic (semaglutide) compared to non-pharmacologic weight loss strategies exaggerate the occurrence of adverse effects? A literature search was conducted using CINAHL and PubMed employing the following search terms: ozempic, semaglutide, weight loss, non-pharmacologic weight loss, adverse effects, and obesity. A total of 12 articles met the inclusion criteria. The research shows that Ozempic (semaglutide) is an effective but short-term weight management aid, as most individuals regain the weight lost within one year. Though Ozempic (semaglutide) demonstrated the highest percent weight loss achieved of any anti-obesity medication (11.85%), it also results in augmented adverse effects. Commonly experienced adverse effects of Ozempic (semaglutide) include vomiting, diarrhea, hypoglycemia, cholelithiasis, tachycardia, thyroid carcinomas, reproductive complications, and stomach paralysis. Nonpharmacologic interventions like diet and exercise were found to be sustainable and have significantly fewer adverse effects, with exercise causing on average a 20% weight reduction. Based on these findings, evidence exists to support implementing nonpharmacologic strategies over Ozempic (semaglutide) for weight loss in overweight individuals.

409. Hearing Function and Executive Functioning after Childhood TBI

Submission Type: Poster

Submission Category: Allied Health

Author(s): Seraphina Hodgson

Faculty Mentor: Jessica Riccardi

Abstract: The overall purpose of this research is to explore the overlap in and functional impact of symptoms related to executive functioning and hearing dysfunction after childhood traumatic brain injury (TBI). Caregivers of children with TBI will complete an online survey, including measures of hearing function, executive function, fatigue, participation, and quality of life. It is expected that children with TBI will have high rates of hearing dysfunction and hearing dysfunction will be associated with greater executive dysfunction. Both executive function and hearing function are expected to be significant contributors to fatigue, participation, and quality of life. The results of this study will support the understanding of the effects of childhood TBI and provide foundational evidence to information speech-language pathology and audiology treatment of children with TBI.

410. Screening for Colon Cancer in Adults Under and Over 50: Effects on Mortality Rates

Submission Type: Poster

Submission Category: Allied Health

Author(s): Lauren Dean, Eve Daries, Ethan Grover, Morgan Howes, Kayla Loughman

Faculty Mentor: Valerie Herbert

Abstract: Recently, there has been an increase in the number of adults under the age of 50 who are diagnosed with colon cancer, and many of these adults are diagnosed with stage III or IV. In 2018, the recommended age for initial colon cancer screening through colonoscopies decreased from age 50 to 45. Despite this, there are rising concerns about the effectiveness of current screening mechanisms and the recommended age for screening. These authors pose the question: among adults under the age of 50, how does colon cancer screening impact mortality rates compared to those over the age of 50? A literature search was conducted using PubMed, CINAHL, and Nursing Reference Center Plus with the following search terms: colon cancer, screening, mortality, young adults. Requirements included that all articles be peer-reviewed and published in 2019-2024. A total of 12 articles met the inclusion criteria. The current evidence has shown that colonoscopies are effective in preventing colon cancer in adults aged 50 and older and have led to decreases in mortality rates for this group. Research suggests that routine screening in adults 45 and younger could also help to diagnose colon cancer at earlier stages and decrease mortality rates. Studies conducted outside the United States have shown that alternative screening methods, such as blood and fecal testing, are useful in screening young adults for colon cancer. Based on these findings, future recommendations include lowering the age requirement for colonoscopies and increasing accessibility to alternative screening methods.

411. Student Nurse Clinical Experience in a Dedicated Education Unit

Submission Type: Poster

Submission Category: Allied Health

Author(s): Kendall Doyle

Faculty Mentor: Valerie Herbert

Abstract: New graduate nurses are reporting gaps in clinical expertise and knowledge when transitioning from student to new graduate nurses. The student clinical experiences are paramount to the new graduate nurses' transition into practice. It is imperative that school of nursing (SON) programs and clinical settings collaborate to provide the best possible clinical experience. One clinical model that can be utilized is the dedicated education unit (DEU). In this work, I will demonstrate the clinical impact the DEU model has in increasing clinical expertise. This will be done by reviewing peer-reviewed articles that relate to the DEU clinical module, the traditional clinical module, and the new graduate transition. This evidence will be compiled to create a pilot DEU to support the learning gaps identified by newly graduated nurses. A hospital unit that can provide consistent staff as DEU mentors on the same day every week will need to be identified. A SON program and clinical group will need to join the pilot. Collaboration between hospital leadership and the SON will be essential to meet students' objectives. The development of the DEU will require education and training for the DEU mentors and clinical staff. This DEU training will need contribution from SON, including course and student objectives. The goal is to confirm both a clinical student group and an inpatient acute care unit for a DEU pilot clinical group.

412. The Clinical Judgment Measurement Model and Improving Student Clinical Judgment

Submission Type: Poster

Submission Category: Allied Health

Author(s): Sara Carr

Faculty Mentor: Valerie Herbert

Abstract: Nurses provide care to clients in complex situations. Nurses entering practice need greater confidence and skills to make sound clinical judgment decisions when caring for clients. A question arises: do structured clinical judgment activities based on the Clinical Judgment Measurement Model (CJMM) improve students' clinical judgment skills throughout a semester simulation and clinical rotation? A literature search of EBSCOhost, CINAHL, Next Generation: NCLEX News, and article reference lists were used. Peer-reviewed articles published from 2018-2023 were reviewed, resulting in 13 articles being selected. The literature demonstrated that nursing schools work to prepare nurses for entry-level practice by designing a curriculum with didactic classes using active learning opportunities, skills labs, simulations, and clinical settings. The CJMM provides a structure used to determine a nurse's ability to make decisions for clients and is noted to be done in a progressive way to incorporate all five layers when determining a nurse's clinical judgment skill. Each layer builds on the nurse's skill to recognize and analyze cues and make appropriate decisions regarding client care. Incorporation of level three of the CJMM, which includes recognizing cues, analyzing cues, prioritizing hypotheses, generating solutions, taking action, and evaluating outcomes, in nursing education can make an impact on nursing students' clinical judgment skills in preparation for entry-level practice. Using the CJMM in nursing education offers a foundation to build sound clinical judgment skills. Continued research on best practices for the CJMM and ways to embed it in nursing education is necessary.

413. Screening for Sarcopenic Obesity in Community-Dwelling Older Adults: The Role of the Family Nurse Practitioner in Primary Care

Submission Type: Poster

Submission Category: Allied Health

Author(s): Nicolette Wallace

Faculty Mentor: Kelley Strout

Abstract: Sarcopenic obesity (SO) is the combination of excess adiposity and sarcopenia. The pathogenesis is intricate and includes aging, physical inactivity, malnutrition, inflammation, and hormonal changes (Wannamethee & Atkins, 2023). The global prevalence of SO in community-dwelling older adults is 1 in 10. That number is expected to increase as the population ages and the obesity epidemic surges (Batsis & Villareal, 2018). SO is associated with more negative health consequences than sarcopenia or obesity alone, including increased cardiovascular disease (CVD), Type 2 Diabetes Mellitus (T2D), falls, and hospitalization (Wannamethee & Atkins, 2023). Risk factors for SO include age over 70, chronic diseases, recent acute disease, nutritional events, history of falls, lower educational status, lower income, Hispanic race, and food insecurity (Donini et al., 2022) (Jeng et al., 2018) (Gandham et al., 2021) (Fonesca-Perez et al., 2022). The treatment for SO is a high-protein diet, resistance training, and careful calorie restriction (Egsleer et al., 2023). Patients respond better to interventions when started between ages 50 and 70; therefore, it is ideal to start screening at that time (Egsleer et al., 2023). There are numerous screening tools available, however, the European Working Group on Sarcopenia in Older People (EWGSOP) recommends the SARC-F plus grip strength testing and Timed-up-and-go go test (Ackermans et al., 2022). Guidelines are not clearly defined in the U.S. However, the Family Nurse Practitioner (FNP) still has the ideal skills to screen all community-dwelling older adults for SO and prevent negative health consequences.

414. Enhancing Cardiac Rehabilitation: Promoting Psychological Well-being Across Diverse Cardiac Conditions Through Mindfulness-Based Interventions

Submission Type: Poster

Submission Category: Allied Health

Author(s): Sheri Tarr

Faculty Mentor: Sean Sibley

Abstract: Following a cardiac event, especially among patients with diverse cardiac conditions such as myocardial infarction (MI), cardiac arrest, congestive heart failure (CHF), and those who have undergone coronary angioplasty and stenting, many individuals experience heightened levels of depression and anxiety. Mindfulness-based interventions (MBIs) offer potential benefits for individuals undergoing cardiac rehabilitation, addressing both mental health and overall well-being. While traditional approaches focus primarily on physical recovery, integrating MBIs into cardiac care protocols acknowledges the importance of holistic healing. This review aimed to assess the impact of MBIs, particularly Mindfulness-Based Stress Reduction (MBSR), on psychological resilience and quality of life among patients with cardiac disease. Through a comprehensive review of relevant literature MBIs, including MBSR and Mindfulness-Based Cognitive Therapy (MBCT), demonstrated efficacy in reducing anxiety, depression, and fatigue while enhancing self-efficacy and overall quality of life among cardiac patients. Shorter or adapted versions of MBIs also prove effective, showcasing their flexibility and adaptability in diverse clinical settings. The synthesis of findings underscores the importance of integrating MBIs into comprehensive cardiac rehabilitation programs to improve patient outcomes. Moreover, this study highlights the pivotal role of healthcare providers, particularly family nurse practitioners (FNPs), in advocating for the incorporation of MBIs into cardiac care. By aligning evidence-based practice with patient-centered care, FNPs can enhance the overall well-being of cardiac patients.

415. Holistic Healthcare: Bridging the Gap with Primary Mental Health Care

Submission Type: Poster

Submission Category: Allied Health

Author(s): Peter Nyame

Faculty Mentor: Eva Quirion

Abstract: The integration of mental health services into primary care settings is crucial for addressing the holistic well-being of individuals, particularly in light of the interconnected nature of physical and mental health. However, prevailing gaps persist, marked by a shortage of mental health professionals, limited resources, and enduring stigma surrounding mental health treatment. Notably, the state of Maine faces significant challenges in ensuring equitable access to mental health care, with a substantial portion of the population lacking sufficient support. The COVID-19 pandemic has further underscored the urgency of integrating mental health services into primary care, amplifying existing challenges and necessitating adaptive strategies. Collaborative care emerges as a pivotal approach, emphasizing coordinated efforts among primary care providers, mental health specialists, and other healthcare professionals. Successful implementation of integrated mental health services requires multifaceted strategies, including workforce training, policy reforms, technological innovations, community engagement, and patient education. Despite challenges, evidence supports the efficacy of collaborative care models in improving patient outcomes, reducing healthcare costs, and promoting resilience in healthcare systems. Moving forward, prioritizing the integration of mental health services into primary care is essential for fostering comprehensive, patient-centered care and building healthier communities.

416. Historical Trauma and the Support of Wabanaki Elders Caring for Indigenous Children

Submission Type: Poster

Submission Category: Allied Health

Author(s): Susan Plissey

Faculty Mentor: Mary Tedesco-Schneck

Abstract: The Indigenous Wabanaki population in Maine have experienced centuries of trauma. In the United States removal of children from their parents and tribal communities in an effort of planned cultural genocide has continued for decades. In 2016, Maine and federal laws sought to protect Indigenous children from being separated from their families and communities. When Indigenous children require removal from their biological parents, the priority is placement within their Indigenous community, and the care often falls onto elders. However, many Indigenous elders experience significant challenges when children are placed in their care as a result of the consequences of historical trauma that they have endured.

To support Indigenous elders in the care of Indigenous children, family nurse practitioners (FNPs) must understand these challenges, implement interventions, and advocate for resources and policies. A systematic review of the literature on evidence-based clinical guidelines to support Indigenous elders and the children in their care can inform practice, policy and research for FNPs and other primary care providers .

Keywords:

Indigenous elders, Wabanaki, healthcare disparities, historical trauma

417. FITnurse: A Mindful Physical Activity Intervention for Nursing Students

Submission Type: Poster

Submission Category: Allied Health

Author(s): Maile Sapp, Rebecca Schwartz-Mette, Kayla Parsons, Jade McNamara

Faculty Mentor: Kelley Strout

Abstract: This research aims to evaluate FITnurse, a pre-semester mindful physical activity intervention, on well-being and performance in first-year nursing students.

In a non-randomized control trial, first-year nursing students participated in a 6-day introductory mindfulness course self-selecting into FITnurse or a mindful eating intervention control group for 4 daily 90-minute sessions. Participants subsequently engaged in mindfulness doses over 14 weeks. Questionnaires were distributed before (T1), immediately after (T2), and at semester's end (T3). Perceived Stress Scale, Oldenburg Burnout Inventory, State Mindfulness Scale-Physical Activity, and Five-Facet Mindfulness Questionnaire scores were collected.

Fifty-four nursing students participated(90.3% female, 93.5% white, M-age=19.3 years). Controlling for baseline levels of each dependent variable, multilevel models predicted outcomes from T1, assessing immediate and semester-long effects. The control (n=27) reported increased stress ($b = .11$, $p < .05$) and burnout ($b = .08$, $p < .05$) at T3, but no significant increases were observed for FITnurse (n=27). Both groups reported increased state mindfulness at T2 (FN: $b = .50$, $p < .001$; C: $b = .77$, $p < .001$), but only FITnurse reported improvements at T3 ($b = .20$, $p < .05$). The control reported increased mindfulness skills at T2 only ($b = .15$, $p < .001$), whereas FITnurse reported marginally significant increases at T3 ($b = .05$, $p = .06$).

Preliminary analysis suggests that FITnurse had immediate and semester-long positive impacts on students in conjunction with mindfulness training. Specifically, FITnurse has the potential to (a) buffer against stress and burnout during the academic semester (b) increase mindfulness (c) bolster mindful strategies.

418. Using Steamed Broccoli Sprouts to Better Understand Bacterial Glucosinolate Metabolism

Submission Type: Poster

Submission Category: Allied Health

Author(s): Marissa Kinney, Johanna Holman, Alexis Kirkendall, Emelia Tremblay, Mazie Gordon

Faculty Mentor: Sue Ishaq

Abstract: Inflammatory bowel diseases (IBD) lead to dysfunction of the gastrointestinal (GI) tract, resulting in disruption to overall health. These diseases can affect people of all ages and are present on a global scale. Research has demonstrated that diets high in cruciferous vegetables, such as broccoli, are associated with decreases in GI inflammation. Broccoli contains glucoraphanin, which through metabolism by gut bacteria, can become an anti-inflammatory compound, sulforaphane. Recent research has validated the use of steamed broccoli sprouts in the diet of mice to reduce inflammation and resolve symptoms of IBD. Isolated microbiota samples obtained from various locations in the GI of these mice are being investigated for the presence of glucoraphanin-metabolizing genes from a common gut bacteria, Bacteroides thetaiotaomicron (B. theta). Similar analyses being conducted on human fecal samples from individuals who consumed steamed broccoli sprouts for 28 days have demonstrated decreases in the presence of B. theta. This result was not anticipated and has strengthened beliefs that B. theta is not the primary species performing glucoraphanin metabolism, thus prompting further analyses of the fecal samples from mice and humans for glucoraphanin-metabolizing genes of other common GI bacteria. Genomes of isolates from the gut of mice which have high quantities of glucoraphanin-metabolizing genes will be sequenced for identification. This information will help to identify potential bacterial candidates for future research on probiotic development.

419. Empowering Patient Safety and Enhancing User Experience with a User-Friendly Healthcare Application

Submission Type: Exhibit

Submission Category: Allied Health

Author(s): Samson Cournane

Faculty Mentor: Jon Ippolito

Abstract: This research project intends to develop a cutting-edge healthcare software that makes vital medical records easily accessible. A healthcare provider's qualifications, reviews, certifications, and areas of specialization can be quickly and easily accessed through the app using QR code software. In addition, users can receive enhanced support throughout their healthcare journey by constructing a personalized care team with medical professionals, family, and friends.

You can personalize your app experience with the use of the app's adjustable settings. These include language and notification preferences, account and app preferences, and a feedback mechanism.

Integrating Google Authentication is a major feature of the app because it provides a secure and easy way to access the app, which improves the login process and data security. With Firebase as its data storage backend, the app offers a safe and scalable solution for healthcare data management.

The app aims to enhance the safety of patients and empower individuals to make educated choices about healthcare providers by providing access to critical healthcare information. However, the goal of the project is to improve healthcare outcomes in the future through increased transparency and the use of mobile technology for treatment.

420. Identification of Variables Influencing Perfluorooctane Sulfonic Acid (PFOS) Serum Levels in Rodents Through Feature Selection Data Mining Methods

Submission Type: Poster

Submission Category: Allied Health

Author(s): Lilian Nowak, Kizito Nishimwe, Andre M. Mendoza, Ana Jimenez Lagos, Sarah Benner, Glenda Pereira

Faculty Mentor: Juan Romero

Abstract: This study aimed to identify variables influencing perfluorooctane sulfonate (PFOS) serum levels in rodents using data from the Web-of-Science database. Analysis of 12 publications on rodents extracted variables such as publication ID, sex, species, body weight, exposure duration to PFOS, treatment categories, daily PFOS exposure extent and PFOS levels in liver and serum, where available.. The data was arbitrarily split into training (70%) and test (30%) sets for model development and accuracy assessment. LASSO and ridge algorithms were used on the training subset with a 10-fold cross-validation approach. stepwise multiple regression using the Akaike Information Criterion (AIC) were employed for analysis using R 4.3.2. The RMSE (root mean squared error) obtained when analyzing the test subset were 27.9, 28.5, 36.0, 28.4, and 28.0 (µg/mL of plasma PFOS), and the number of variables in the model (exclusive of the intercept) was 5, 14, 16, 16, 14 for LASSO set to lambda.1se and lambda.min, Ridge set to lambda.1se and lambda.min, and stepwise (respectively). Models indicated a significant, positive correlation between PFOS levels and both exposure duration and extent (µg/Kg of BW/d), with stepwise regression showing a slightly lower median of absolute errors compared to LASSO (P= 0.05) Similarly, stepwise identified a positive relationship with exposure duration and extent when the effect of publication was included in the model (Adj. R^2= 0.93).

421. Clinical Applications of Ketogenic Diet and Medium Chain Triglyceride Supplementation in Patients with Mild to Moderate Alzheimer's Disease

Submission Type: Poster

Submission Category: Allied Health

Author(s): Ottilia Boros

Faculty Mentor: Sean Sibley

Abstract: Alzheimer's dementia (AD) is a slowly progressing neurodegenerative disease characterized by progressive cognitive decline, behavioral disturbances, diffuse brain atrophy, impaired neuronal function, brain insulin resistance, and deposits of beta amyloid plaques and tau protein tangles. AD affects one in every eight persons in the United States over the age of 65 and one in every three people over the age of 80. Conventional medicines slow the progression of the cognitive decline, but are unable to stop or reverse the disease. The aim of this review is to evaluate if ketogenic diet (KD) and medium chain triglyceride (MCT) supplementation, cause improvement in cognition when compared to glucose or a high glycemic index diet in patients with mild to moderate AD. There were 15 relevant articles selected from various databases and the findings were synthesized for clinical practice implications. Based on current clinical evidence, the KD appears to be a great option for adjuvant therapy in the treatment of mild to moderate cognitive impairment in the early stages of AD. This review provides examples for clinical applications of KD and MCT supplementation in the primary care setting as part of dietary counseling. Future research is needed to evaluate the short and long term use of KD and MCT supplementation and their effects on cognition and progression of AD.

Keywords: Alzheimer's Disease, family nurse practitioner, ketogenic diet, ketone body, medium chain triglyceride, low glycemic load, low carbohydrate diet.

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501. Developing Integrin α2β1 Knockdown Cell Lines for 3D Breast Cancer Spheroid Migration Models

Submission Type: Oral Presentation - 9:30 AM, Classroom B

Submission Category: Engineering and Information Sciences

Author(s): Jordan Miner, Joseph Raite, Andre Khalil

Faculty Mentor: Karissa Tilbury

Abstract: There is a lack of knowledge in distinguishing low- versus high-risk early-stage breast cancer tumors due to heterogeneity of cancer progression. Therefore, it is essential to develop biomarkers to differentiate invasive cancers. Interestingly, aggressive breast cancer has elevated levels of integrin α2β1 which plays a role in cellular migration and metastasis to secondary locations in the body. Therefore, we are using the MCF10A cell series – four cell lines that mimic the progression of breast cancer from non-tumorigenic to metastatic – to develop 3D in-vitro spheroid models to understand the impact of integrin α2β1 on cellular migration. We hypothesize that reduction of integrin α2β1 expression may reduce cellular migration. Using shRNA transduction and adhesion assays, we are reducing integrin α2β1 expression [knockdown (KD)] in each of the MCF10A cell lines and validating the expression by Western blots and fluorescent staining. Once expression is reduced by 60% or more, spheroids will be generated with a seeding density of 4,000 cells with 2.5% Matrigel. After 72 hours of culture, spheroids will be embedded in a 2 mg/mL collagen hydrogel for 3D migration experiments. Brightfield images will be acquired every 12 hours using a BioTek Cytation 5 and cellular migration distance will be quantified on a single cell level using a custom FIJI analysis program. We anticipate that the KD spheroids will have decreased cellular migration distance compared to the wildtype controls.

502. Enhancing Tumor Microenvironment Analysis Through Combination of Multiscale Anisotropy and Principal Component Analysis

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Joshua Hamilton

Faculty Mentor: Andre Khalil

Abstract: The architecture of the tissue microenvironment early in tumor onset holds key prognostic and diagnostic information. The CompuMAINE lab has contributed to our understanding of early tumor organizational changes through the development of multiscale quantitative tools using the Wavelet Transform Modulus Maxima Method (WTMM). One tool we developed named the WTMM Anisotropy Method has found multiscale organizational changes in mouse melanoma, human pancreatic ductal adenocarcinoma (PDAC), and human breast cancer. When an image is analyzed using our method an anisotropy factor is calculated for each wavelet size scale where the anisotropy factor is a measure of tissue organization. Currently, anisotropy factors are compared between images on a scale-by-scale basis ignoring any within image anisotropy factor scale relationships. This work focuses on utilizing more information from the WTMM Anisotropy Method using principal component analysis (PCA). The first use of PCA is to determine what scale relationships are most meaningful for image or patient-wise clustering. This was tested using our PDAC and breast cancer datasets where PC2 from PCA on the datasets weighed the large vs small wavelet scales matching our published empirical results. The second use of PCA is to remove noise from the data caused by larger wavelet scale convolutions having less data. PCA on a large dataset of Brownian noise and white noise images matches our earlier published coefficient of variability results. This allows us to normalize our anisotropy factor results more accurately. Overall, PCA allows us to improve multiscale analysis through utilization of intra-image wavelet scale relationships.

503. Fabrication and Evaluation of Cellulose Nanofiber Composite For Bone Tissue Regrowth

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Adeola Fadahunsi, Cameron Andrews

Faculty Mentor: Michael Mason

Abstract: Every year, millions of people suffer from critical bone injuries that require medical interventions that rely on repair materials. In such cases, the use of autografts (using the patient's own bone tissue) and allografts (using cadaveric tissue) as repair materials are the most preferred treatment options. However, concerns like donor scarcity, disease transmission, and auto-rejection remain. Natural biomaterials including alginate, gelatin, chitin have been studied extensively as bone repair material in pure form and as composites with bioactive minerals, like hydroxyapatite (HA), collagen etc., but these biomaterials show limitations, such as poor mechanical strength, cellular integration, and lack of vascularization. Cellulose nanofiber (CNF) has gotten comparatively little attention among the biomaterials investigated thus far, despite its remarkable similarity to collagen (the major organic component of bone), such as natural occurrence, fibrous form, toughness, and nanoscale dimensions. These properties make it a potential bone repair material.

Our research aims to fabricate a Cellulose nanofiber composite, evaluate its physical and mechanical properties, invitro cytotoxicity, propensity for MC3T3 cell adhesion, differentiation, biomineralization, and overall bone regrowth in vivo using a critical defect in rabbit model. If proven successful, this new material will address the pressing need for alternatives to harvested bone (autograft, allograft) and contribute to the broader goal of improving healthcare and patient well-being.

504. Unveiling Sex-Specific Differences in Ocular and Cardiovascular Hemodynamics: Insights from the Eye2Heart Model

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Mohamed Zaid, Lorenzo Sala, Caleb Hendrick, Alon Harris

Faculty Mentor: Giovanna Guidoboni

Abstract: The study aims to characterize the hemodynamic impact of known structural and functional differences in men and women using a novel EYE2HEART mathematical model of systemic and retinal circulation. Specifically, the model is used to investigate sex-specific differences in ocular and systemic vascular biomarkers, namely blood pressure (BP) and peak-systolic velocity (PSV) in the ophthalmic artery (OA) and central retinal artery (CRA). Markers of systemic and retinal circulation - systolic BP (BP SYS), mean arterial BP (MAP), PSV in the OA, and CRA - simulated by the model are compared to those measured clinically within early-stage open-angle glaucoma (OAG) patients from the Indianapolis Glaucoma Progression Study (IGPS) and within the literature. Early-stage OAG eyes are selected when the visual field Humphrey's mean deviation (MD) is >-6 dB (n=804). Statistically significant differences in markers are analyzed using a Kruskal-Wallis test.

Results show that markers simulated by the model align consistently with the mean clinically obtained values. Notably, women exhibit a statistically significant lower BP SYS (127.0 vs 121.4 mmHg) and MAP (90.6 vs 85.9 mmHg). This reduction results in a significantly lower OA PSV (26.2 vs 24.1 cm/s). Smaller CRA diameter compensates for the lower velocity in the OA, where there is no significant difference in the CRA PSV (9.4 vs 9.6 cm/s).

In conclusion, model findings emphasize the importance of accounting for sex-specific differences in cardiovascular function when assessing ocular hemodynamics. Results highlight the potential of theEYE2HEART model for predicting and understanding these relationships in the context of diseases.

505. Maine Paper Technology: A New Way to Create Affordable Fluidic Devices

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Liza White

Faculty Mentor: Caitlin Howell

Abstract: Microfluidic devices have many different applications from diagnostic testing to biosensors; however, the production of the devices is complex, expensive, and time-consuming. By leveraging the Maine paper industry technology, we looked to develop cost-effective, mass-manufacturable fluidic devices. Specifically, three different fluidic devices were developed at the microliter/hr, liter/hr, and kiloliter/hr for creating precise emulsions, for continuous water disinfecting using an electrical field and for detecting water contaminates, respectively. The precise emulsion device produced droplets with a volume of 225 pL at a rate of 120 droplets/min. The water disinfecting device was optimized by including a surface texture that focused the electric field. The water contaminates detection device detected methylene blue dye at 5 µg/mL and produced results similar to commercial UV-Vis spectrophotometers. These results demonstrate the potential of Maine paper industry technology to produce cost-effective, mass-manufacturable fluidic devices.

506. Multi-Component Liquid-Infused Systems: A New Approach to Functional Coatings for Biomaterials

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Zach Applebee

Faculty Mentor: Caitlin Howell

Abstract: Surfaces engineered to capture and retain liquid, forming a thin overlayer of liquid in the process, a class of material called liquid-infused surfaces (LIS), have found utility across the globe due to their diverse applications, including repelling water, preventing the adhesion of ice and bacteria, and self-cleaning. Recent research has started exploring the broader potential of LIS by incorporating additional components into the liquid. In this work, we present the concept of multi-component liquid-infused systems (MCLIS), in which the coating liquid consists of a primary liquid and at least one secondary component, and review recent examples. At the molecular scale, MCLIS consisting of silicone oils infused with bacterial quorum sensing inhibitor compounds have been shown to stop bacterial biofilms from adhering and forming. At the nanoscale, MCLIS made from ferrous magnetic nanoparticles within fluorocarbon-based fluids or silicone oil can change their shape upon exposure to magnetic fields, making them useful for actively removing adherent fouling organisms. Alternatively, MCLIS fabricated by first adding free particulates to the surface of a spherical droplet, then allowing the decorated droplet to be coated with an immiscible liquid, resulting in a 3D-coated MCLIS system. At the microscale, microdroplet arrays using more than one liquid in a defined pattern have been fabricated and used for high-throughput detection of compounds. By introducing secondary components into the liquid of these LIS, additional mechanisms can be introduced into the coating, creating novel opportunities for applications within the biomedical realm and beyond.

507. Characterization of Commercial Catheter Surfaces with Bio-Inspired Liquid-Infused Surfaces

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Evan Leonard, ChunKi Fong

Faculty Mentor: Caitlin Howell

Abstract: Hospital-acquired infections (HAIs) affect over 1.7 million patients annually and are often treated with antibiotics, which can contribute to antibiotic resistance. Catheter-associated urinary tract infections (CAUTIs) are the most common type of HAI, resulting in an estimated $390-450 million in treatment and increased length of stay-associated costs annually.

Previously, a bio-inspired coating on commercial catheter surfaces has demonstrated the ability to reduce the need for antibiotics by minimizing both protein and bacterial adhesion to the catheter surface as well as the spread of bacteria to other organs. In this work, we treated commercial catheters with the bio-inspired liquid-infused coating to investigate changes in properties such as length, mass, and diameter. Additionally, confocal microscopy was used to examine the catheter and coating interface, while material mechanical testing was conducted to quantify bulk material properties post-coating application. Treatment of the commercial catheters with the bio-inspired coating resulted in increases in measured parameters but changes were dependent on the starting outer diameter of the catheters. The measured oil overlayer height was 56.51 (±18.45) µm in fully treated samples and could be reduced to 13 (±7.95) µm when the oil layer was mechanically stripped. The material's hardness was decreased from 82.20 to 79.65 Shore OO due to the addition of the bio-inspired liquid coating. Through the development of liquid-infused treatments for commercial catheters, we aim to create a widely available, cost-effective solution for preventing CAUTI and reducing the need for antibiotic use in patients who need indwelling catheters.

508. Cellulose Nanofibril Coatings as Plastic Replacements for Food Packaging with New Scalable Coating Method

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Sandro Zier, Douglas Bousfield

Faculty Mentor: Caitlin Howell

Abstract: Plastic is omnipresent in food packaging but is challenging to recycle, leading to significant and growing environmental pollution. Coating biodegradable paper packaging with cellulose nanofibrils (CNF) is one promising approach to replace plastic; however, the nature of CNF makes it difficult to coat evenly onto paper.

In this work, we demonstrate a new coating method that effectively applies a CNF suspension onto paper in only one step that can be easily scaled up to large scale manufacture. The method uses a vacuum in combination with a coating element, to remove excess water from the CNF. Other parameters and additives to the CNF were optimized.

Initial tests gave a uniform layer with a final coating weight on the paper that could be tuned between 12 and 28 g/m^2, significantly higher than previously reported results. The air permeability is reduced by over a factor of 1000 even for the lowest coat weight of 12 g/m2. The oil and grease barrier properties are excellent and a dramatic improvement over uncoated paper.

We anticipate that our new approach to coating CNF will help to speed the adoption of sustainable and biodegradable materials in food packaging, helping to replace plastic and reduce plastic pollution in our oceans.

509. Liquid-Infused Paper Surfaces as a Low-Cost Alternative to Spheroid Culture Plates

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Ainslie Allen, Jordan Miner, Liza White, Karissa Tilbury

Faculty Mentor: Caitlin Howell

Abstract: Three-dimensional (3D) cell cultures like spheroids can more accurately replicate in vivo conditions, making them a better model to study cell behavior, drug responses, and disease mechanisms than 2D cultures. However, current methods of forming spheroids rely on the use of expensive treated well plates or do not allow for long culture periods. In this project, we explore the use of folded silicone release paper (SRP) with a slippery liquid surface to reduce the cost of spheroid formation. To test this hypothesis, we analyzed the surface of SRP cups before infusion, after infusion, and after sterilization by measuring the weight of the cups and the sliding angle of a 10μL droplet of distilled water on the cups. We then cultured spheroid-forming cells in non-infused cups, infused cups, cups drained after infusion, and cups with excess liquid to identify the optimal level of infusion for spheroid formation. Finally, we compared the results of these experiments to spheroids formed using traditional ultra-low attachment microplates by analyzing the area of the spheroids produced in ImageJ. This work shows promise in lowering the cost of forming spheroids, thereby accelerating progress in the various fields reliant on 3D cell culture models.

510. Solar-Powered Sterile Water Production: Sustainably Addressing Medical Needs in Developing Nations

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Ainslie Allen, Jack Dunning, Sydney Sheehan, Kaitlyn Sterner

Faculty Mentor: Caitlin Howell

Abstract: Access to clean water, while it is improving, is still a major issue in many third world countries. In the regions where access to potable water is improving, the necessity for medically sterile water remains critical, particularly for the production of intravenous (IV) saline used to combat severe dehydration, prevalent among children afflicted with gastroenteritis. This project, called the Solar Still, is dedicated to fulfilling the demand for sterile water in medical facilities within third-world countries through the implementation of solar-powered technology. The Solar Still uses a solar panel to convert sunlight into electricity. This electricity is stored in a battery, converted to AC, and powers a heating mantle. The mantle boils water, and a condenser collects the evaporated water, channeling it into a sterile reservoir. The Solar Still was tested for quality and efficiency. The quality of the sterile water was tested to ensure it meets the water for injection (WFI) standards set by the United States Pharmacopoeia. The efficiency was tested by calibrating and verifying the accuracy and function of each of its components. This endeavor holds promise for enhancing healthcare infrastructure and addressing pressing medical needs in resource-limited settings.

511. Smart Tourniquet

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Madeline Williams, Hailey Buchmiller, Charles Rulon, Caleb Hendrick

Faculty Mentor: Karissa Tilbury

Abstract: Tourniquets can be the difference between life and death in emergencies. First responders do not currently have a way to determine the ideal pressure for tourniquet application. The dangers of over-tightening or under-tightening a tourniquet can have substantial effects on patient outcomes: under-tightening can fail to stop bleeding, and over-tightening can crush tissues and result in ischemia, which jeopardizes cellular viability and can cause long-term complications. The purpose of this work is to design a self-regulating tourniquet that calculates and applies the amount of pressure needed to stop bleeding while minimizing tissue damage. The applied pressure is based on an algorithm to collapse the arterial vessels with minimal pressure to reduce crush damage. The smart tourniquet monitors the applied pressure and heart rate data with integrated sensors and reports elapsed time to help physicians make informed treatment decisions. The smart tourniquet will be tested on a biofidelic limb mimicking the structure and size of the upper arm with 3/4-inch copper pipe simulating the humerus, 5/32-inch surgical tubing and a peristaltic pump simulating the pulse and pressures in the brachial artery, and ballistic gel simulating soft tissue. The features being tested include the ability to accurately detect and report heart rate, display elapsed time, and respond to changes in pressure and blood flow by inflating and deflating accordingly. The objective is to prove that the smart tourniquet can: (1) stop the flow of blood, and (2) inflate and deflate in response to changes in pulse and blood pressure.

512. Vein Finder

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Alexis Plater, Meredith Mitchell, Sara Maslaczynska-Salome, Gabriella Rospide

Faculty Mentor: Andre Khalil

Abstract: Venipuncture, the process of puncturing a vein for a medical procedure, can pose challenges for healthcare workers in cases where veins are difficult to locate. Such scenarios can lead to repeated attempts at piercing a vein, increasing patient discomfort, delaying care, and in extreme cases, causing scarring and nerve damage. Current vein finding techniques and devices do not address the pain and discomfort caused by the venipuncture procedure itself and are not inclusive when it comes to patient age, weight, and skin tone. The project goal is to develop a readily portable, user-friendly device that assists in vein location and reduces pain, thereby increasing efficiency of vein puncture in emergency and clinical settings. To accomplish this goal, an innovative device has been designed utilizing near-infrared imaging technology to detect veins beneath the skin surface and provide real-time visual guidance to healthcare providers whilst also distracting the patient from the sensation of needle insertion. The device's performance will be evaluated via Durability Tests (physical drops and cleaning processes), an Accuracy Test (ability to locate veins on a range of patients), and a Pain Distraction Test (ability to distract a patient from sensation). The device will improve the quality of patient care through a more inclusive and patient-centered vein finding technique.

Acknowledgements:

The authors thank Dr. David Neivandt, Dr. Robert Bowie, Dr. Todd O’Brien, Dr. Ray Kennard, and Mr. Kyle Guerrette for materials, brainstorming help, and critical advice.

513. Smart Survival Jacket

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Erin Davenport, Anna Baldwin, Bianca Breton, Sairah Damboise, Damon Williams

Faculty Mentor: Lisa Weeks

Abstract: Hikers, outdoorsmen, first responders, etc. have a risk of becoming lost or getting injured while in the wilderness. The current market offers products providing one or a combination of, but not all, the following survival considerations: hydration, nourishment, communication, navigation, shelter, and first aid. A need therefore exists for a wearable solution that provides all the survival considerations and aid to persons in need over multiple days in adverse conditions to increase likelihood of survival. To meet this need, the current team fabricated a jacket to provide survival aid and biometric feedback of heart rate, respiratory rate, body temperature, and hard fall detection. The success of this device was verified in three ways: accuracy of vital monitoring, effectiveness of insulation, and increased visibility for search and rescue. The accuracy of the vital monitors were verified by comparing simultaneous measurements of the jacket monitors to the vitals' gold standards. The effectiveness of insulation was analyzed using the COMSOL program by modeling a heat transfer diagram to display the reduced conduction of external temperature through the jacket. To verify the increased visibility of the survival jacket, to aid search and rescue teams, visibility tests were performed in varying weather conditions and a range of distances on both the survival jacket and an on-market jacket. The results demonstrate that the need presented by the current market is met by the designed jacket as it provides aid and resources to persons in need thereby reducing emergency response times and increasing the likelihood of survival.

514. Remote Acquisition of Vital Signs

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Matthew Sarapas, Isaac Plourde, Oluwadamilola Kolawole, Malyar Muti

Faculty Mentor: Michael Mason

Abstract: Unmanned Aerial Vehicles (UAVs, drones) are becoming more widely used in search-and-rescue services due to their ability to traverse complex terrain efficiently when searching for the lost or injured. If these UAVs could also gather information about the medical status of the people they locate, that information could be used to inform clinical decisions. This presents a need for a drone-mountable device used to monitor important vital signs of patients in diverse situations providing medical information for use by emergency services. This issue is being approached through a combination of a physical mountable device and computational image analysis. The device targets a low-power laser on the subject, resulting in a visible spot being projected, a video of which is recorded using the UAV's integrated camera. The resulting video will then be analyzed to isolate fluctuations in the size and geometry of the laser spot due to the vibrations induced in the body by respiration and the beating of the heart. The frequency spectrum of these fluctuations will be used to determine the frequencies of the subject's respiration and pulse, providing clinical data that will help guide decision-making by rescuers.

Acknowledgements: We would like to thank Dr. Robert Bowie and Dr. David Neivandt for their expertise and assistance as instructors, and Dr. Michael Mason for technical advisement on this project.

515. Transcutaneous Titanium Ports that Promote Fluid Flow and Include a Porous Structure to Enable Skin Ingrowth to Form a Barrier and thereby Prevent Infection

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): LeeAnn Varnum, LouLou deVallance, Anna Folley, Lindsay Pierce

Faculty Mentor: David Neivandt

Abstract: Gastronomy tubes (G-tubes) were invented in the 1800s and since then have seen minimal advancements. G-tubes act as a pathway for medicine or nutrients into the body or drain stomach acid out of the body. Current G-tubes travel directly from the stomach lining to the outside of the body without an interface. G-tubes are critical medical devices but have significant flaws such as high risk of infection and leakage of stomach acids where the tubing passes through the skin (leading to third-degree burns). The objective of the current project was to design an indwelling externally porous port that would promote skin and soft tissue ingrowth, facilitate fluid flow through two attached tubing segments, and act as a permanent fixture for patients who require a G-tube. The port's unique exterior titanium lattice structure would allow integration with the skin and underlying soft tissues. The port would thereby create a barrier to prevent infection, leakage in the area surrounding the port, and would last for years without being replaced. The port would act as an interface connecting the internal and external tubing, facilitating flow rate of fluids, maintaining minimal leakage, and would enable internal tubing replacement without extensive surgeries or entire port removal. The port will be tested for leakage, flow rate, acid resistance, and dimensionality between CAD design and printed result. With the creation of the transcutaneous porous metal port, the quality of patient life will be dramatically improved due to decreased leakage and infection as well as fewer necessary procedures.

516. Synergistic Effects of Thermomechanical Pulp Fibers, Cellulose Nanofibrils, and Surfactants in Fabricating High-performance Insulation Foams: A Structure-property Relationship Study

Submission Type: Oral Presentation - 9:45 AM, Classroom A

Submission Category: Engineering and Information Sciences

Author(s): Rakibul Hossain

Faculty Mentor: Mehdi Tajvidi

Abstract: Driven by sustainability and safety concerns, the search for renewable, low-carbon intensive, and safer alternatives to traditional synthetic and inorganic building insulation foams is accelerating. This study proposes a novel and facile method to fabricate surfactant-assisted cellulose nanofibrils (CNFs)-reinforced thermomechanical pulp (TMP) fiber-based foams with excellent thermal insulation, mechanical, water resistance and sound absorption properties. Firstly, the effect of the addition of TMP fibers and CNFs on the stability of the sodium dodecyl sulphate (SDS) foams at different SDS dosages were investigated by studying the foamability, foam volume stability, foam liquid stability, and bubble size distribution over time. The findings indicate that CNFs effectively stabilized SDS foams by forming Pickering droplets and reducing the coalescence of the bubbles, whereas TMP fibers exhibited limited stabilization capability. The findings from the foam analysis paved the way for controlling the thickness, density, porosity, and pore structure of the foams by varying the SDS and fiber content. Foams of different formulations with tunable density between 15-100 kg/m3 could be made by varying the SDS, TMP fiber, CNF, and solids content. Higher SDS contents reduced foam density, while higher solids contents increased it. Higher density foams had better mechanical and sound absorption properties than the low-density ones. The mechanical strength improved with the increase of CNF content. All foams showed low thermal conductivity (0.033-0.041 W/m-K) and the pore structure had a significant effect on the thermal conductivity values. The foams were hydrophilic with very high water absorption values. Foams were made hydrophobic by surface and bulk modification with hexamethylene diisocyanate in a supercritical CO_2 medium. Modified foams showed high water resistance with significantly lower water absorption properties. Overall, this study proposes a novel way to control the properties of the SDS-assisted CNFs-reinforced TMP fiber-based foams by tuning the pore structures and density for biobased sustainable building and packaging insulation applications.

517. University of Maine Athletic Inventory System

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Collin Rodrigue, Sean Radel, Brennan Poitras, Gabe Poulin, Graham Bridges

Faculty Mentor: Laura Gurney

Abstract: This is a capstone project for the University of Maine Athletics Department. Our group of five computer science students is developing a web application to assist in the management and tracking of the University of Maine Athletic Department equipment and item inventory. The key stakeholders for our project are Jude Killy, Nick Fox, and Kevin Ritz. Jude Killy submitted the project on behalf of the athletic department to combat the issue of an inefficient inventory management process. Currently, Nick Fox and Kevin Ritz are tasked with managing inventory orders and distribution of items to players and teams. Currently, this process is only documented on a spreadsheet. Our group is developing a solution that can increase the efficiency of entering data items, storing inventory data, and tracking the distribution to athletes and teams. Our solution replaces the old inventory management solution Front Rush and the currently used strategy that's a combination of Excel spreadsheets and word of mouth to track inventory.

518. Comparing Anisotropy of H&E Stained Breast Tissue Histology Slides Across Differing Color Spaces

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Skyler Morse, Joshua Hamilton

Faculty Mentor: Andre Khalil

Abstract: Breast cancer is one of the most common and deadly forms of cancer in the United States, having an age-adjusted rate in 2020 of 119.2 diagnoses for every 100,000 people. Because of this, an early diagnosis through the use of imaging techniques can be crucial to patient survival. One of these techniques is the multiscale anisotropy analysis of breast biopsy slide subsections using the 2D Wavelet Transform Modulus Maxima (WTMM) anisotropy method. This project explores the use of the Haematoxylin, Eosin, DAB (HED), and the Hue, Saturation, Value (HSV) color space channels as opposed to the standard grayscale channel in hopes of finding a channel that better distinguishes the differences between isotropy and anisotropy in benign and malignant slides. From a Wilcoxon test of the benign and malignant anisotropy factor distributions at every WTMM size scale, it was found that the Value-channel from the HSV color space showed the most distinction between the benign and malignant slide subsections. The use of this color space channel in future analysis may allow clinicians to make a better diagnosis, and if caught early may have the potential to better patient survival as well.

519. Rheological Analysis of Hydrogel Precursors Infused with Algae

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Slesha Tuladhar

Faculty Mentor: Bashir Khoda

Abstract: Hydrogels, renowned for their remarkable water-absorption capabilities and biocompatibility, play crucial roles in various biomedical and engineering applications. However, ensuring the long-term structural integrity of hydrogels remains a persistent challenge, particularly when incorporating live cells into hydrogel compositions to create bio-ink formulations. This introduces complex hydrogel-cell interactions, posing significant threats to their integrity, longevity, and functionality. Investigating the rheological properties, particularly the intricate shear-thinning behavior of cell-infused hydrogel precursors, is vital in addressing these multifaceted challenges. As a result, we prepared a series of hybrid hydrogel compositions, incorporating sodium alginate, carboxymethyl cellulose (CMC), and TEMPO-mediated Nano-fibrillated cellulose (TO-NFC), to which algal constituents were added. We conducted an extensive study of the rheological behavior of these composite hydrogel precursors over time to understand their suitability as bio-ink formulations. Additionally, we monitored cell growth using a hemocytometer. Surprisingly, our investigation revealed a significant decrease in viscosity in many compositions, which was closely linked to the growth of algae integrated into the hydrogel precursor. We anticipate that the composition comprising sodium alginate (4%), CMC (1%), and TO-NFC (1%) will exhibit optimal printability under a 3D bio printer. This finding highlights the critical importance of considering supplementary components in hydrogel precursors, as viscosity alterations can profoundly affect the performance of these hybrid systems. Moreover, these novel findings have broad theoretical implications and immediate practical relevance, contributing significantly to our understanding of these complex relationships and facilitating the development of innovative materials with superior properties and performance attributes. The newfound understanding of viscosity modulation in these hybrid systems has the potential to optimize the design and utilization of hydrogel-based materials, particularly in the realm of 3D bio printing.

520. Granular Activated Carbon Oxygen Content After Thermal Regeneration Representing a Change in Surface Functional Groups Responsible for PFAS Adsorption

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Danny Houder, Dilara Hatinoglu

Faculty Mentor: Onur Apul

Abstract: Granular activated carbon (GAC), a form of graphite manufactured from organic materials, has an extremely porous structure that is highly effective at trapping contaminants in water by adsorption. One such contaminant is Per- and Polyfluoroalkyl Substances (PFAS), a class of over 4700 chemicals harmful to humans known as "forever chemicals" due to their extremely strong molecular bonds and cyclical waste stream. PFAS removal by adsorption to GAC is currently lowest in cost and highest in efficacy out of a broad range of PFAS water treatment technologies, making it the industry gold standard. As the GAC becomes saturated with PFAS, it is typically sent to landfills or incinerators, inevitably reintroducing PFAS to the environment. The practice of thermal regeneration seeks to simultaneously remove the PFAS from the GAC while also preserving the desirable physiochemical properties of the material. This study investigates the thermal regeneration of 5 different GAC's (dry and wetted) with varying physiochemical properties using a thermogravimetric analyzer operated at a 25°C/minute heating ramp reaching 750°C under pyrolytic conditions with a 60 mL/minute flow of N2. GAC's surficial functional groups determine the surface charge of the activated carbon pores, and influence how effective electrostatic interactions are as an adsorption mechanism of GAC. Oxygen content before and after thermal regeneration of the GAC correlates with the pH of the material, which determines electrostatic interaction availability. Changes in oxygen content pH after thermal regeneration indicate potential interference with adsorption mechanisms which could have ramifications on the efficacy of the GAC.

521. Engineering a Compostable Isolation Gown to Reduce Hospital-Derived Synthetic Waste Accumulation in Landfill

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Caden Scott

Faculty Mentor: David Neivandt

Abstract: The ever-increasing accumulation of synthetic waste in landfills is a growing pollution and public health concern. In 2018, hospitals in the United States landfilled 1.5 million tons of personal protective equipment (PPE). Single-use, disposable PPE gowns constitute the greatest percentage of landfilled PPE by weight and are overwhelmingly made from non-degradable synthetic materials. The most common and disposed of type of PPE gown are isolation gowns, which are used by healthcare workers attending patients under isolation precautions. One study has shown that under isolation procedures, healthcare systems will on average dispose of 33 gowns per patient per day as municipal waste, contributing a substantial amount of solid waste to landfills. Therefore, to alleviate the strain on landfills, a need exists for isolation gowns that do not contribute to the accumulation of synthetic waste. The approach taken in the present work to address this need was through the creation of a degradable textile from which to make isolation gowns. The prototype textile is a paper-based substrate with a compostable functional coating to grant the barrier properties necessary to prevent liquid penetration. The compostable, lightweight, coated paper product was tested in accordance with the ASTM F3352 Standard Specification for Isolation Gowns Intended for Use in Healthcare Facilities. The prototype was found to exceed the physical strength requirements and possess better barrier properties than most commonly used isolation gowns. In addition, the prototype was demonstrated to exhibit qualitative and quantitative signs of degradation after 42 days under industrial composting conditions. Due to these properties, the prototype textile has been identified as a suitable material from which to create compostable isolation gowns.

522. A Study Into the Fundamentals and Enhancements of Solenoid Based Accelerators

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): William Poole

Faculty Mentor: David Kotecki

Abstract: The design and implementation of a coilgun is a complex task due to the multitude of variables in the design of the system. Coilguns are inefficient and have a peak efficiency of around 22% [1]. Even with the low efficiency, there is much interest in coilgun systems due to their ability to accelerate objects faster than chemical reactions with speeds nearing 3km/s [1]. In addition to the peak speed, there are other advantages such as the reduced contact with the projectile and controllable launch speeds which allow for applications including the launching of nano-satellites [2]. To understand coilgun systems, a research project has been undertaken to analyze and understand the design tradeoffs influencing coilgun efficiency. The research project investigated the solenoid design, controls, power components, and parasitics. A Matlab model of a coilgun was produced and a physical coilgun was made to better understand the key issues in a coilgun system. Results show that large correlations exist between the armature, solenoid, initial conditions, power, and system parameters to performance.

[1] "EM Mortar Technology Development for Indirect Fire. Retrieved May 9, 2011" (PDF). Archived (PDF) from the original on January 26, 2021. Retrieved April 27, 2021.

[2] Malcolm W. Browne (January 30, 1990). "Lab Says Electromagnetism Could Launch Satellites"

523. Experimental Study Of Thermal Performance Of A Solid-To-Gas Counter-Flow Heat Exchanger

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Rollan Lemieux

Faculty Mentor: Justin Lapp

Abstract: A direct-contact counter-flow heat exchanger is a device where solid particles and a gaseous mixture flow through a pipe in opposite directions to stimulate heat transfer between the mediums. A team led by Dr. Justin Lapp is currently fabricating a propane dehydrogenation (PPDH) reactor that acts as a direct-contact counter-flow heat exchanger between solar-heated catalyst particles and propane gas. The objective of this project proposal is to determine the effects of varying particle size and mass flow rates on the heat transfer effectiveness of Dr. Lapp's PPDH reactor. Analyzing the effectiveness of a high-temperature heat exchanger designed to catalyze a chemical reaction is a novel concept in literature. Understanding the thermodynamics of this reactor will advance the development of direct-contact heat exchangers for use in chemical reactions as well as solar energy collection methods.

524. Virtual Video Modeling for Adults with Autism

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Nick Sarno, Tristan Cilley, Maha Fazli, Jacob Michaud, Allison Lupien

Faculty Mentor: Laura Gurney

Abstract: The versatility of virtual reality technology provides a unique opportunity for interacting in an immersive and realistic environment. Our project takes advantage of this experience in order to assist adults with autism in practicing social skills. Working with our client Dr. Sarah K. Howorth, a Special Education Professor at the University of Maine, we used the PEERS© curriculum written by UCLA's Dr. Elizabeth Laugeson as a basis for developing a virtual video modeling application. Our goal was to create a proof-of-concept demonstrating that VR can be a more immersive environment to facilitate learning and practice social skills.

With permission from Dr. Laugeson, we have based our proof-of-concept on the original PEERS© mobile application. Due to the lack of privacy, immersion, and realism in traditional textbook-style learning, Dr. Howorth proposed creating an experiential virtual reality alternative. This immersive VR application more closely represents the experience a person would encounter in a real conversation with the added benefit of being able to practice in a safe and private environment.

Our project was implemented in the Unity game engine. The VR controls and user interfaces are designed to present the content of the PEERS© curriculum in a clear and concise way. Additionally, implementation of 360 degree videos demonstrates the potential of the software's capabilities. Our application allows users to choose from a multitude of lessons, each pertaining to a different social situation and includes example role-play videos, exercises, and a final quiz. The goal of this proof-of-concept is to enable future research on the effectiveness of learning in a VR environment through data tracking of user progress and interaction.

525. Designing a Wireless Blueberry Harvesting Sensor System

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Anthony Caccese, Alexandra Gale, Kenzie Young, Dharani Singaram

Faculty Mentor: Laura Gurney

Abstract: The wild blueberry stands as an influential crop in Maine's agricultural landscape, accounting for 95% of the U.S.'s harvested yield and contributing $68 million in revenue in 2022. This profitable crop is difficult to harvest due to its sizable genetic diversity, resulting in significant height variance among plants and complicating the harvesting process. It requires a skilled laborer to operate the harvester to minimize damage to crops that can occur during harvesting. Therefore, the automation of the harvesting process could result in both quality and monetary benefits. Our capstone course team, TerraCode, has worked with Dr. Bashir Khoda and Dr. Lily Calderwood to address these issues focusing on providing an intuitive and innovative solution to assist in harvester operations. The Wild Blueberry Sensor System provides an application interface to display immediate feedback regarding the harvester's current surroundings and operating parameters. Utilizing this information, the system suggests changes in operation to optimize harvester yield. Key features include environmental sensors for monitoring blueberry bush height, harvester speed, rake rotational speed, and rake height, with corresponding data displayed on the Android tablet. Moreover, the system allows farmers to customize data recording and parameter calculations through the tablet interface, ensuring adaptability to specific harvesting conditions. Importantly, the system prioritizes safety by issuing warnings when operations deviate from predetermined safe ranges. Ultimately, the Wild Blueberry Sensor System promises to revolutionize wild blueberry harvesting practices, empowering farmers with an advanced interface that streamlines operations, enhances yield, and preserves crop quality.

526. Comparison of the Life Cycle Impacts of Materials for Large-Format Additive Manufacturing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Josephine Adu-Gyamfi

Faculty Mentor: Reed Travis Miller

Abstract: Large-format additive manufacturing (LFAM) is transforming contemporary manufacturing by facilitating the production of customized large-scale components. The widespread adoption of LFAM necessitates a thorough examination and comparison of the environmental impacts linked to various materials used in this innovative manufacturing process.

This study concentrates on assessing the life cycle environmental impacts of two commonly used composite materials in LFAM: 1) carbon fiber with ABS plastic and 2) wood flour with bioplastic. As these materials play a significant role in 3D printing, comprehending their environmental effects throughout their life cycle is imperative for the advancement of sustainable manufacturing practices.

The University of Maine Advanced Structures and Composites Center (ASCC) has employed materials like carbon fiber with ABS plastic and wood flour with bioplastic for 3D printing large-scale structures, including homes, speedboats, culverts, and precast concrete formwork. The study encompasses thorough data collection and analysis across each life cycle stage, addressing raw material extraction, manufacturing processes, transportation, product use, and end-of-life scenarios.

While carbon fiber is recognized for its energy-intensive production, limited publicly available Life Cycle Assessment (LCA) studies are available. Wood flour, often viewed as a waste product, is assumed to possess minimal embodied burden, a hypothesis necessitating careful examination. Life cycle data from a variety of sources will be compared. The research will investigate impact categories such as climate change, human health, and ecosystem toxicity. The results will contribute to discussions on environmentally conscious and sustainable manufacturing practices, offering a basis for optimizing large-format additive manufacturing processes.

527. Homogenization for Additive Manufacturing via Complex Variable Methods

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Christopher Bock

Faculty Mentor: Masoud Rais-Rohani, Brett Ellis

Abstract: Additive manufacturing's inter-bead voids present unique challenges for homogenizing as-printed materials. These challenges include irregular void shapes, inconsistent void shapes within a single part, anisotropic properties of surrounding materials, and multiple-hour runtimes for traditional analysis techniques, such as finite element analysis (FEA). This work addresses these challenges by developing a complex variable method to homogenize as-printed materials. The developed method employs a conformal map in the form of a Laurent Series to account for arbitrary void shapes, and complex variable elasticity to account for anisotropic properties of surrounding materials. A validation study comparing the complex variable method and FEA indicates stress concentrations were within 15% for a rhomboidal-shaped void. Next, the effect of void shape on homogenized moduli of as-printed materials was examined via a parametric study of 2,500 shapes bounded by circular, triangular, and rhomboidal voids. Results indicate as-printed materials containing rhomboidal-shaped voids were stiffer, and materials with triangular-shaped voids were more compliant. In addition to producing similar results to those of FEA, the complex variable method's analytical approach resulted in simulation times that were > 1,000 times faster than FEA. This work is significant in that the developed complex variable method facilitates analysis and design under uncertainty, thus furthering the predictability and usefulness of additive manufacturing.

528. Fast Object Compositional Neural Radiance Field

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jeffrey Eiyike

Faculty Mentor: Vikas Dhiman

Abstract: We present a method for object-level reconstruction while maintaining effective novel view synthesis. Although Neural Radiance field (NeRF) based techniques generate high-quality novel views, such models use a neural network to learn the radiance of each point within the scene. Object or shape manipulation with NeRF is challenging because the models are scene-specific and lack individual 3D object representation. Our approach decomposes the NeRF scene into objects and reconstructs them one object at a time. This approach has two main advantages. Firstly, it allows us to learn object-class level NeRF models that can reconstruct some object classes with multi-view images; we can

move the objects and recombine them back into a single scene. Our approach for object-level reconstruction is to detect and segment objects using YOLO, followed by reconstruction per object and recombination into the scene for potential downstream applications.

529. Comparing the Environmental Impacts of Rice Husk Ash and Cement in Concrete Production

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Erfan Najaf, Eric Landis

Faculty Mentor: Reed Miller

Abstract: This study presents a Life Cycle Assessment (LCA) to evaluate the environmental impacts of using Rice Husk Ash (RHA) as a partial replacement for cement in concrete production. Cement production is a major environmental concern, responsible for approximately 8-10% of global CO2 emissions and significant energy consumption. The research aims to explore the sustainability aspects of concrete, focusing on greenhouse gas emissions, energy consumption, and resource depletion throughout its lifecycle, from raw material extraction to disposal. The use of RHA, a byproduct of rice milling, in concrete is investigated as a sustainable alternative. RHA offers potential benefits such as waste reduction, energy conservation, and a reduction in the carbon footprint associated with traditional cement production. Additionally, RHA can improve concrete properties, such as durability and strength, due to its pozzolanic nature. Concrete made with RHA not only exhibits better properties but is also a greener alternative to traditional concrete. The study also addresses potential environmental concerns related to the production and transportation of RHA, as well as the implications of its use on the overall environmental performance of concrete.

530. NURBS Defined Stiffened Panels

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Andrew Persson

Faculty Mentor: Masoud Rais-Rohani

Abstract: This study presents a Life Cycle Assessment (LCA) to evaluate the environmental impacts of using Rice Husk Ash (RHA) as a partial replacement for cement in concrete production. Cement production is a major environmental concern, responsible for approximately 8-10% of global CO2 emissions and significant energy consumption. The research aims to explore the sustainability aspects of concrete, focusing on greenhouse gas emissions, energy consumption, and resource depletion throughout its lifecycle, from raw material extraction to disposal. The use of RHA, a byproduct of rice milling, in concrete is investigated as a sustainable alternative. RHA offers potential benefits such as waste reduction, energy conservation, and a reduction in the carbon footprint associated with traditional cement production. Additionally, RHA can improve concrete properties, such as durability and strength, due to its pozzolanic nature. Concrete made with RHA not only exhibits better properties but is also a greener alternative to traditional concrete. The study also addresses potential environmental concerns related to the production and transportation of RHA, as well as the implications of its use on the overall environmental performance of concrete.

531. High-Performance Computing in Virtual Machines

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nathan Price, Melissa Kimble

Faculty Mentor: Laura Jackson

Abstract: High-performance computing (HPC) is a powerful tool for processing vast amounts of data and assisting in complex computations across many fields, such as artificial intelligence, healthcare, and space exploration. With the rise of consumer products like ChatGPT, the demand for HPC administrators and engineers has grown significantly.

Traditional HPC systems rely on expensive hardware, presenting accessibility challenges for educational institutions and small organizations. Despite the availability of commercial virtualized services, costs remain high, and direct access to system components is often limited to practitioners, hindering learning.

Here, we propose an entirely simulated HPC system that provides an affordable and flexible learning environment for exploring HPC architecture and operations. This system will support hands-on exploration of HPC topics focusing on scalable computing resources. The goal is to help users understand how computational tasks can be distributed and managed effectively to increase job efficiency. With a "learning-by-doing" approach, learners gain the knowledge and skills to navigate and conceptualize the architecture of these systems. This also allows them to gain the necessary understanding to make informed architectural design choices with the foresight of how those choices will affect end-users.

This research will be a novel solution for a fully functional and easily replicated HPC system within virtual machines (VMs). Replication instructions include Ansible playbooks for automated setup, bash commands for manual installation, and pre-configured VM images. Detailed documentation, including network diagrams and code explanations, will accompany the replication instructions in a public code repository.

532. Automation of ROVs for Marine Life Inspection

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Jacob Wildes

Faculty Mentor: Vikas Dhiman

Abstract: Tracking marine species is an important task for aquaculture and monitoring ecosystem health. We use submersible robots to detect and count species via cameras. To detect fish species in images, we use neural networks. In the discipline of neural networks, object identification is largely developed for terrestrial applications. However, aquatic applications are largely undeveloped. Most open source repositories and datasets for fish identification are hard to replicate or inaccessible. As such, the focus of this project is to develop a neural network that is capable of identifying fish, and if possible, indicate its species. After development, the network will be deployed on a small single board computer with a balance of computational capability and low power consumption. Our proposed pipeline functions by receiving an image and then predicting how likely an object in the image is to be a fish. If it does predict a fish, it will draw a box around it and label it with a species or just the identifier, “fish.” Those images are then saved to be viewed later. The overall goal is to provide an easily modifiable model to the open-source community that can be extended for various aquatic monitoring applications.

533. Tackling Leading Edge Erosion of Offshore Wind Turbine Blades: Accelerated Rain Erosion Investigation of Curved Wind Turbine Material

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Henry Willard, Gabe Fein, Josiah Bloom, Amrit Verma

Faculty Mentor: Amrit Verma

Abstract: The erosion of wind turbine blades at the leading edge is a complex problem that reduces the aerodynamic efficiency of blades, ultimately affecting the overall cost of energy. Efforts are being made to counter the erosion of blades, such as testing and developing advanced coating solutions. However, most of these studies assume that the coated surfaces are flat and the surface curvature at the blade's leading edge is neglected. This study develops a test campaign to investigate the effect of the surface curvature of the sample on rain erosion behavior. To this end, a Rain Erosion Tester (RET), originally developed by a team of mechanical engineering capstone students, was redesigned and significant modifications were made to facilitate an accelerated rain test with different curved samples. Further, the RET was calibrated to ensure that important specifications, such as the velocity of the water jet, mass flow rate, and frequency of water jet creation, were known. An investigation was conducted on quantifying the incubation and post-incubation behavior of Aluminum 6061 T6 samples with different surface curvatures, subjected to accelerated high-velocity rain impact ranging from 100 to 120 m/s. Furthermore, the study aimed to check the feasibility of using the Springer equation and applying a correction factor to the model considering the curvature of the material. This improved prediction ability will be useful for offshore wind turbine blades that are curved. Especially in blades with large variability in leading-edge radius.

534. Sequential Transfer for Multi-Source Transfer Learning

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nicholas Jacobs, Aayush Manandhar

Faculty Mentor: Salimeh Yasaei Sekeh

Abstract: Transfer learning (TL) aims to improve data efficiency by leveraging knowledge from existing pre-trained models. While TL techniques are impactful, they have two significant downsides: they suffer from catastrophic forgetting and often only utilize a single source model. In a sequential setting, catastrophic forgetting occurs when a model learns a new task and, in the process, forgets a previous task. Additionally, single-source methods cannot take full advantage of the diversity of existing pre-trained models. This work proposes a sequential transfer learning method where a target model sequentially learns from multiple source models. Our method is unique compared to existing TL methods that use only a single source and existing multi-source methods that require all source models during training. Existing single source methods cannot utilize the diversity of knowledge that multiple sources can offer, limiting their robustness.

Sequential transfer reduces the memory requirements during finetuning as the source models do not need to be trained in parallel, allowing models to be finetuned with fewer resources. Additionally, model selection and new model integration is very flexible with sequential transfer. The step-by-step process permits the incorporation of new models into already optimized models, with the option to revert if the new model does not improve performance. To minimize the risk of catastrophic forgetting, we used an approach that learns the relationship between the source and target model labels and collaboratively supervises the finetuning process. We conduct several experiments to evaluate our approach empirically on standard benchmarks.

535. Ghost Connect-Net: A Connectivity-Based Companion Network to Enhance Pruning Methods

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Mary Wisell

Faculty Mentor: Salimeh Yasaei Sekeh

Abstract: Deep Neural Network (DNN) approaches excel in various real-world applications like robotics and computer vision, yet their computational demands and memory requirements hinder usability on advanced devices. Also, larger models heighten overparameterization risks, making networks more vulnerable to input disturbances. Recent studies aim to boost DNN efficiency by trimming redundant neurons or filters based on task relevance. Instead of introducing a new pruning method, our project aims to enhance existing techniques by introducing a companion network, Ghost Connect-Net (GC-Net), to monitor the connections in the original network. The initial weights of GC-Net are equal to the connectivity measurements of the consecutive layers in the original network. Once the connectivity-weights in GC-Net have been created and loaded, a pruning method is then applied to GC-Net. Then, the pruned weights are mapped back to the original network determining pruned connections. Our method monitors the information flow in the network while compressing the layers. Through GC-Net we combine both magnitude and connectivity based pruning methods by applying magnitude based pruning approaches to the connectivity-weights values of GC-net. The next phase of our research involves evaluating GC-Net's performance, stability, certified robustness, and impact on generalization gap through experiments using benchmark datasets like CIFAR-10, CIFAR-100, MNIST, and common CNN architectures such as ResNet and VGG.

536. Virtual Reality Exposure Therapy

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Madox Hussey, Mohammed Fazli, Danny McA'Nulty, Michael Massari, Nickolas Millett

Faculty Mentor: Laura Gurney

Abstract: Many people suffer from a wide range of phobias negatively impacting daily life. Exposure therapy is proven to be an effective method for treating phobias through repeatedly exposing a patient to their fear in a controlled environment to assist in alleviating the fear. For some phobias, such as flying, it is prohibitively expensive to repeatedly enter the fear triggering environment. In these cases a simulated exposure can be very effective. Working with local clinical psychologist Dr. Gordon Street, our project focuses on the designing and development of an exposure therapy application using Virtual Reality (VR). VR allows a patient to be 'placed' in a simulated scene to help them overcome their phobias. The several existing applications available are either prohibitively expensive, lack evaluation demos, or are not available in the US due to HIPAA non-compliance. In collaboration with Dr. Gordon Street the focus has been on creating a driving scene, a pretty common phobia, which is not easy to expose patients to without potentially endangering themselves and others. The prototype requires building an effective VR scene that makes the patient feel as if they are in a real vehicle. It should provide the therapist with controls to moderate and guide the patient's experience while limiting expenses and ensuring HIPAA compliance. These controls will allow the therapist to change the weather and light, navigate the patient's VR vehicle between different areas simulating highway, city, and rural driving, and monitor the patient's anxiety level throughout the therapy session. Future work will include creating scenes to address other phobias, including spiders, water, and flying.

537. Advanced Hybrid Electrodes for Enhanced Detection of a model PFAS compound - PFOA: "A Promising Approach in Environmental Sensing."

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Sanskar Shrestha, Wenhu Wang

Faculty Mentor: Sharmila Mukhopadhyay

Abstract: Electrochemical sensing has emerged as a valuable method for detecting various toxic compounds, and our research endeavors to enhance its capabilities through the development of novel hybrid electrode structures. Commonly used electrodes, such as carbon paste electrodes (CPEs) and glassy carbon electrodes (GCEs), often face limitations in sensitivity due to their limited surface area. To address these constraints, a novel design integrating nanotubes and nanoparticles onto porous substrates is investigated, utilizing reticulated vitreous carbon (RVC) foam hosting vertically aligned carbon nanotube (CNT) arrays. The RVC foam, distinguished by high electrical conductivity and fluid permeability, serves as an optimal base, while CNTs contribute to an ultra-high surface area with adsorption sites and charge transfer pathways. Catalytic nanoparticles, such as palladium (Pd) or tungsten sulfide (WS2), enhance electrochemical interactions with the component to be detected (analyte). The analyte selected for this study is perfluorooctanoic acid (PFOA), one of the most common types of PFAS (poly and perfluoroalkyl substances) contaminants. It is seen that the hierarchical hybrid electrodes investigated here offer a stable and highly sensitive platform for detection of PFOA, underscoring the potential of these innovative electrodes in environmental sensing, particularly in identifying harmful forever chemicals.

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

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Christian Silva, Callen Shaeffer, Jackson Cyr, Caiden Emerson, Kevin Bretthauer

Faculty Mentor: Susanne Lee

Abstract: In service to the state of Maine's food waste reduction plan, we have undertaken a software development project aimed at reducing food waste on the individual level. Continuing on work done on the Waste Watcher app, as requested by Senator George J. Mitchell Center for Sustainability Solutions, we are producing a deployable application designed to allow users to track their food waste on a meal-to-meal basis that is available on both the App Store and Google Play Store.

The reduction of food waste has been named a state priority, and we have designed Waste Watcher as a powerful tool for the University of Maine to blaze a trail of progress toward solving this issue. Waste Watcher is designed to use elements inspired by social media, and other market-leading personal development apps to inspire change in users' behavior, leading them to make more sustainable decisions about the purchasing and disposal of their food waste.

In the United States, an alarming 40% of our food supply is wasted, with over half of this waste occurring in individual households. This is particularly harmful in Maine, which has the highest rate of food insecurity in New England. Approximately 1 in 8 adults and 1 in 5 children in Maine face food insecurity. By monitoring our household food waste, we can significantly contribute to reducing food insecurity, lowering our food expenditures, and more. Our team thoughtfully designed and implemented Waste Watcher to make it simple to track your food waste, compete with friends, and learn food waste facts and tips to inspire personal accountability regarding food waste.

539. Maine Artificial Intelligence Arena

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Graham Berry, Chloe Hodgdon, Hannah Kline, Henry Kindler, Sophie Kummer

Faculty Mentor: Laura Gurney

Abstract: Maine Artificial Intelligence Arena (MAIA) is a University of Maine Computer Science capstone project for client Dr. Zachary Hutchinson. MAIA is a modular 2D simulation providing students experiences with writing AI scripts. Inspired by MIT's Battlecode, MAIA facilitates AI education and supplies infrastructure allowing educators to focus on students rather than creating similar infrastructure software. Schools have varying levels of STEM resources and funding; MAIA offers accessible and equitable access to a similar experience to MIT's Battlecode. Each participating MAIA team creates an AI Python script, according to specified formats in the MAIA documentation to utilize objects and components provided in the game. AI scripts are then given to an administrator to load into the team's directory on the local computer. The administrator implements the game mode and map where the team's AI scripts compete to win various tasks based on the configured scenario. The goal of this project is to take the application from a research prototype, previously created by the client, to a beta stage for real-world tests. To achieve this goal, we implemented the following updates: redesigned the user interface (UI) and configuration settings to be more user-friendly and accessible; improved the simulator's behavior to be more predictable; expanded the default virtual worlds allowing for additional variety in maps and game modes; and improved the documentation of the program in depth and clarity.

540. Automated Soil Irrigation Moisture Monitoring Sensor System

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Arthur Smallidge

Faculty Mentor: Prabuddha Chakraborty

Abstract: Irrigation is essential in not only commercial agriculture, but anywhere that water is a scarce resource. Perhaps no other place will be more pressed for optimal and efficient irrigation as space habitats. Space exploration, however, is not the only application of this system. Small scale growers may find this system to be a valuable tool, especially in arid regions where water is limited. Fellow researchers may use the system as well, to determine the optimal soil moisture or irrigation frequencies of food crops to determine the least amount of water that yields optimal yields. This project explores how microprocessors and soil moisture sensors can be unitized into one package for simple deployment. The sensor system consists of a microprocessor, capacitive moisture sensor, battery backup, and power/signal cable. The microprocessor has a small amount of temporary data storage in the event there is a loss of communication with the controller, such as loss of power from supply, or inadvertent cable disconnection. Once communication is restored, the unit will synchronize its data to the controller and resume normal operation. The single power/signal cable will simplify installation, without the need to run separate cables for power and data. Finally, the cable assembly will be easy to connect or disconnect from the controller and the sensors to make reconfiguration quick and simple.

541. The Role of Nanobubbles in Phenanthrene Adsorption: Towards Removal of Dimethylsilanediol from Wastewater on the International Space Station

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Madison McCarthy, Kenneth Mensah

Faculty Mentor: Onur Apul

Abstract: NASA aims to improve the wastewater treatment system efficiency on the International Space Station by preventing the accumulation of dimethylsilanediol (DMSD), part of the siloxane chemical group, in the filters. A catalytic reactor was trialed but had low removal efficiency. Adsorption has proven to be a potentially effective alternative. Meanwhile, recent literature has indicated that nanobubbles in water can improve the hydrophobic interactions between hydrophobic adsorbents like carbon and organic pollutants such as PFAS. However, it is not yet established whether this nanobubble-enhanced adsorption phenomenon applies to DMSD. DMSD is highly volatile and difficult to measure. As a preliminary step towards DMSD adsorption studies, we investigated the adsorption of a simple structure polycyclic aromatic hydrocarbon, phenanthrene (PNT), as a model organic pollutant. Adsorption tests will be performed using graphene, graphene oxide, and reduced graphene oxide and different adsorption matrices viz degassed water and nanobubble water. The findings from this study will provide fundamental insight into the behavior of organic pollutants like PNT in a nanobubble-enabled adsorption system. The results will be compared with previous nanobubble-enabled adsorption works to provide a background understanding of how different compounds behave in a nanobubble-enabled adsorption system and factors to consider towards DMSD removal. This will reveal how the presence of bubbles in water favors or limits the adsorption of various organic pollutants in water. This research is crucial for developing technology that can manage spacecraft waste efficiently and with limited resources, allowing NASA to continue expanding its space exploration.

542. The Effects of Water Annealing on Cellulose Nanofibril Composites

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Cameron Andrews, Cady Kluck

Faculty Mentor: Michael Mason

Abstract: The study of cellulose nanofibrils (CNF) as a novel material has been heavily researched at the University of Maine. CNF has desirable properties, such as sustainability, biodegradability, and biocompatibility, making it a candidate material for new investment in biomedical research. Currently, CNF is produced in bulk at the University of Maine, supporting many pivotal research opportunities for this project. CNF has specific geometric and surface properties making it chemically and mechanically versatile. It is hydrophilic, possesses high mechanical strength, and has moderate porosity in bulk. A specific strategy that is explored in this project is the annealing of CNF. Currently, when dried under high-temperature conditions, the internal strains within the material cause significant bending at varying thicknesses. For example, bending can be observed along the horizontal axis of a 4mm or greater thick sample, and can also be seen from a 0.2mm thick thin film sample. The bending phenomenon increases the difficulty of manufacturing the material for mechanical testing preparation, as well as other physical, chemical, or biological tests that may be conducted. An attempt at internal strain reduction has been explored by experimenting with the rehydration and subsequent drying of CNF. When the internal strains of the material are reduced, there will be increased uniformity of the product, greater mechanical strengths, and decreased wettability after the annealing occurs. This project examines the effects of annealing duration by observing the mechanical properties of the material, as well as the physical changes that occur.

543. Per- and Polyfluoroalkyl Substances Release from Spent Granular Activated Carbon: Standardized Test vs. Simulation of Typical Landfill Environment

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Paulina Alulema

Faculty Mentor: Onur Apul

Abstract: Granular activated carbon (GAC) is a key method for removing per- and poly-fluoroalkyl substances (PFAS) from drinking water sources, but PFAS-laden GACs ultimately end up in landfills. This study investigates PFAS release from spent GACs in landfill environments, examining the impact of physical and chemical GAC properties on two PFAS types (PFOA and PFOS) through standardized leaching tests: Toxicity Characteristic Leaching Procedure (TCLP, Method 1311), Australian Standards Leaching Procedure (ASLP, 2019), and Multiple Extraction Procedure (MEP, Method 1320). The aim is to compare these methods under simulated landfill conditions to understand the mechanism of PFAS leaching from spent GACs in landfills. Four GAC raw materials (bituminous, coconut, lignite, and wood) were assessed based on properties such as surface charge, pore size, surface area, and oxygen content. The study also considered the influence of PFAS type and concentration, as well as leachate chemistry (pH, ionic strength). Results indicated that physicochemical properties dictate adsorption mechanisms, capacity, and leaching rate. Higher oxygen content correlates with lower adsorption capacity and higher leaching rates for PFOA and PFOS. Leachate chemistry and PFAS functional group also affect leaching rates, with PFOA and PFOS showing higher leaching under basic pH conditions typical of aged landfills. The research will also address environmental and health impacts associated with PFAS release into the environment through a lifecycle assessment approach.

544. Parameters that Influence Recycling of Barrier Coated Paper

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Aysan Najd Mazhar, Colleen Walker

Faculty Mentor: Douglas Bousfield, M. Clayton Wheeler

Abstract: Paper-based packaging can obtain barrier properties near that of plastic with coatings, but these coatings can make the paper hard to recycle and hard to break down in the environment. Bio-based barrier coatings may be the key solution but the recycling of these is not clear. The paper properties, barrier layer type, and other processing conditions that lead to good fiber recovery in a recycling system are not clear in the literature.

This study aims to understand the paper and coating layer properties that lead to poor/good recycling applications which are defined by fiber recovery. The key hypothesis of the work is that high penetration of the barrier coating into the paper leads to poor recycling and poor barrier properties because fibers intermix with the barrier material. The influence of paper properties, pre-coating layer, and types of barrier layers (polyethylene, PHA, and others) on fiber recovery were characterized. Base papers properties such as basis weight, thickness, air permeability, and pore volume were characterized. A cellulose nano-fibril (CNF) pre-coating layer was used in some cases to adjust the penetration of the barrier coating layer and to influence the release of the barrier layer upon repulping. Coated samples were characterized in terms of coat weight, water vapor permeability, and pore volume. A lab-based recycling/repulping test method to determine the percentage of fiber recovery was developed as informed by standard test methods. The fiber recovery was found as a function of base paper, the barrier coating type, and the presence of a pre-coating layer.

While it was expected that a barrier layer would cause poor fiber recovery, in most cases, the fiber recovery was over 90%. Polyethylene (PE) coated paper board gave good fiber recovery. The CNF pre-coating layer gave good fiber recovery. Penetration of the barrier coating layer into the paper decreases fiber recovery and the performance of the barrier layer.

545. Exploring the Tissue Engineering Triad for Bone Regeneration

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Christopher Emmerling, Ethan Varney, Lily Smith, Christina Khoury, Joseph Raite, Jordan Potter

Faculty Mentor: Karissa Tilbury

Abstract: Regenerative therapeutics are based on biological scaffolds, signaling molecules, and their interactions with cells. Critical to the development of regenerative bone therapies is a deeper understanding of osteogenic differentiation, the process by which preosteoblasts differentiate into osteoblasts. To study osteogenic differentiation, we used fibrin hydrogels and MC3T3 cells, a preosteogenic cell variant. By using different fibrinogen concentrations (2.5 mg/mL [soft] and 10 mg/mL [stiff]), we tuned the mechanical properties of the fibrin gels to stimulate osteogenic differentiation. Leveraging the tissue engineering triad, we used signaling molecules (ascorbic acid and β-glycerophosphate) to create an osteogenic media. We anticipate that cells encapsulated in 10 mg/mL fibrin gels and treated with osteogenic media will experience a synergistic effect, indicated by higher calcium deposition. After ~21 days, we will measure the calcium deposition using a qualitative Alizarin Red stain and a quantitative plate reader calcium assay. This study allows us to investigate the three components of the tissue engineering triad: preosteoblast cells, ascorbic acid, and β-glycerophosphate as signaling molecules, and fibrin hydrogels as scaffolding. This builds foundational knowledge to design future experiments to elucidate how matrix stiffness and osteogenic signaling molecules could play a significant role in novel bone regenerative medicine studies.

546. Automation of Temperature and Dynamic Strain Sensor Testing Using MATLAB

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Shane Winters

Faculty Mentor: Mauricio Pereira da Cunha

Abstract: Many types of scientific experimentation require repetitive measurements over an extended period (several hours or days). Examples of such measurements include temperature, voltage, and power/frequency spectra. While it is possible to repeatedly perform these experiments by controlling equipment manually, such an approach is time-consuming and prone to error. MATLAB software (MathWorks, Inc.) offers the possibility to control and automate a wide variety of lab test equipment including furnaces, thermocouples, oscilloscopes, and spectrum analyzers. Unlike traditional programming languages such as C/C++, MATLAB abstracts the user away from low-level memory management and communication protocols considerations, allowing for rapid prototyping and testing of software in the loop. This work reports on the use of MATLAB code to automate a testing setup used to simultaneously track the response of temperature and strain sensors. Custom MATLAB functions were written to control each piece of equipment in the setup (furnace, thermocouple, oscilloscope, RF generator, spectrum analyzer, and function generator), and a unified main program file was used to tie it all together. The fully automated test setup was successfully demonstrated to run unsupervised. Temperature and dynamic strain calibration data were gathered from room temperature up to 200 ºC and from 0 $\mu\varepsilon$ to 20 $\mu\varepsilon$, respectively. Such an automated setup offers the ability to acquire a higher quantity of data required for greater accuracy, but not limited to manual measurements, which depended on the presence of an equipment operator.

547. Ozone Nanobubbles Versus Conventional Ozonation: A Life Cycle Assessment of Water Disinfection Processes

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Kenneth Mensah, Onur Apul

Faculty Mentor: Reed Miller

Abstract: Drinking water is sourced from natural resources such as rivers, streams, lakes, and groundwater, which usually contain impurities and require treatment before it is deemed safe for consumption. Disinfection is a crucial treatment step because it inactivates (kills) pathogens that may be present in the water. Ozone disinfection has recently gained popularity because it is less associated with disinfection byproducts and has stronger oxidizing (pathogen-killing) properties than traditional chlorination. However, the downside of ozone is that it is highly reactive, making it unstable (decomposes quickly) and difficult and expensive to operate. Conventional ozonation injects O3 into water using pore diffusers that create macro/microbubbles that are buoyant and unstable, thus further exacerbating the prolonged aeration and high energy demand. Nanobubbles, owing to their smaller size, expansive surface area, high interfacial free energy, and unique non-buoyant properties in solution, are promising avenues to mitigate gas loss during aeration by improving mass transfer efficiency. They act as "gas banks" and diffuse gas into water due to their high stability and internal pressure. Although this solution to ozone depletion by using nanobubbles sounds very interesting, the life cycle assessment (LCA) has not yet been studied. This present study will provide, for the first time, the life cycle assessment of ozone nanobubbles using the OpenLCA gate-to-gate model and compare it with conventional ozonation. The findings will shed light on the comprehensive environmental implications of ozone nanobubbles and ozonation, emphasizing the importance of considering multiple factors in the decision-making process for water treatment.

548. Magneto Hydrodynamic Blood Flow Assist Device

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Faija Farjana

Faculty Mentor: Nuri Emanetoglu, Rosemary Smith

Abstract: Investigation into magnetically driven blood pumps has been an active research area for over a decade. Numerous studies have been conducted on blood pumps because of their applications in open heart surgery, heart-lung machines, left ventricular assist devices (LVAD), and the total artificial heart. Most of them employ mechanical systems to produce or augment the flow. However, the presence of rotary parts in mechanical systems creates health risks, including infection, bleeding, and thrombosis. These limitations of mechanical VADs have led to research on electrical assist devices. In this project, we are examining the use of a Magneto Hydrodynamic (MHD) pump as a blood flow assist device. The MHD pumps follow the principle of Lorentz force; if a magnetic field and an electric field are aligned perpendicular to each other, a force is generated perpendicular to both, according to Fleming's right-hand rule. If the system is placed in a cylindrical tube filled with an electrically conductive liquid, the force created will introduce flow. DC power supply is used to create the electric field, and neodymium magnets generate the magnetic field. An incompressible, Newtonian fluid is considered as the medium of current flow. Results obtained so far, including the mathematical solution, according to the Navier-Stokes equations, and the experimental results to test and validate the model will be presented. The success of the research problem will aid the development of an implantable device to augment flow in patients with single ventricular failure who have an implanted passive shunt via the Fontan Procedure.

549. A Comparative Life Cycle Impact Assessment of Landfill Leachate Treatment Strategies for Per- and Polyfluoroalkyl Substances Removal

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Paulina Alulema, Josephine Adu-Gyamfi

Faculty Mentor: Reed Miller

Abstract: Landfills often act as the final repositories for residential, commercial, and industrial waste containing per- and polyfluoroalkyl substances (PFAS). Treatment plants designed for landfill leachate play a crucial role in mitigating the environmental impact of PFAS contamination. These treatment facilities employ advanced processes to remove or reduce PFAS concentrations from leachate before discharge into water bodies or municipal sewers. This study uses comparative life cycle assessment (LCA) for three scenarios. Scenario 1 involves direct leachate discharge into the environment, scenario 2 includes PFAS removal via granular activated carbon adsorption, and scenario 3 evaluates PFAS removal via sludge-based activated carbon. The assessment will consider raw material extraction, construction of treatment units, and operation. Special attention will be paid to the eventual disposal of PFAS-laden adsorbents. Moreover, key impact categories, including carbon footprint, energy consumption, and potential toxicity, will be examined to assess the overall sustainability of each treatment strategy scenario. Sensitivity analyses will be employed to address uncertainties in data and model parameters, ensuring robust and reliable results. Finally, the study's outcomes will provide valuable insights for environmental scientists, policymakers, and practitioners involved in selecting and optimizing PFAS mitigation strategies, promoting a more sustainable approach to landfill leachate treatment and environmental protection.

550. NER Text Annotation Manager

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Darien Orethun, Sam Waggoner, Wilder Baldwin, Owen Bellew

Faculty Mentor: Laura Gurney

Abstract: Our team enhanced the NER Annotation tool for SpaCy, software that enables users to add text annotations for named entity recognition (NER) tasks. We extended the functionality of the application to allow annotators to more efficiently review text and use outputs as training data for any NER model. This project was our computer science capstone project, requested by Dr. Torsten Hahmann and Ph.D. student Umayer Reza.

Our work aims to improve three primary features: annotation review, annotation editing, and loading and exporting provenance data. The goal is to create a user interface that allows quick, simple, and intuitive actions. To achieve this, we made several contributions. We combined the separate text, annotations, and tags files into a single file to streamline the annotation process. We added the ability to undo any action and replace labels with a single click. Our most significant contribution was creating a new Review Mode that allows users to start with a JSON file of existing annotations, accept or reject each annotation, suggest different labels, and track their progress. We added a history to each annotation such that version control is now possible. The improved tool will expedite the process of creating annotations by allowing users to review and edit the output predictions from a natural language processing (NLP) model, rather than creating annotations from scratch. This reduces the time demands on field experts. This process will also capture valuable feedback that can be used to improve machine learning models.

551. Enhanced Permeation of Per- and Polyfluoroalkyl Substances (PFAS) Through Pinhole Defects in Landfill Geomembranes

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Halle James, Sonia Moavenzadeh

Faculty Mentor: Onur Apul

Abstract: Per- and polyfluoroalkyl substances (PFAS) are widespread environmental pollutants posing significant health risks. These artificial compounds can accumulate in living tissues, increasing the risk of cancer, liver, and kidney damage. The pervasion of PFAS is attributed to their superior resistance to physical, chemical, and thermal degradation. Characterized by robust carbon-fluorine bonds, PFAS demonstrate environmental persistence, making traditional oxidative degradation or natural attenuative processes ineffective for their mitigation.

Landfill leachate is a significant point source of PFAS pollution due to the presence of PFAS in municipal solid waste (MSW). An estimated 11% of PFAS loading to MSW landfills in the U.S. leave via leachate annually, resulting in uncontrolled PFAS emissions. MSW landfill liners act as an essential barrier against PFAS contamination, reducing the likelihood of PFAS spreading into the environment. MSW landfill liners generally consist of a high density polyethylene (HDPE) geomembrane over a geosynthetic clay liner or compacted clay liner.

Our study demonstrates that PFAS exhibit no affinity towards HDPE liners, emphasizing the pivotal role of the geomembranes' physical integrity in containing PFAS. In this research, we investigated various PFAS characteristics, including chain length and functional groups, under differing leachate conditions, including acidic and basic pH levels, temperature variations, and electrical conductivity, to assess how these factors influence PFAS permeation through landfill geomembranes, especially through pinholes that may result from contact with sharp objects. Our results indicate that PFAS can enhance the rate of permeation through such pinholes, primarily due to a reduction in surface tension.

552. Estimating Wild Blueberry Plant Health using Machine Learning Techniques

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Karun Varghese

Faculty Mentor: Vikas Dhiman

Abstract: Monitoring the health and nutrient content of wild blueberries is an important step to understand the evolution of the plant due to climate change and for precision application of fertilizers, insecticides and herbicides. This work uses Hyperspectral data to estimate leaf chlorophyll content and hence nitrogen content in wild blueberries. Once a regression model is developed, it can be used to estimate the nitrogen content of the plant using drone-based surveillance. In this work, we focus on MDATT Indices. We find the MDATT Indices that best correlate with the leaf chlorophyll content. These MDATT Indices are then used with linear regression and multi-layer perceptron models. We have created a fast pipeline for computing MDATT index that allows us to evaluate more data with comparable data analysis pipelines.

553. Investigation of Loss Functions for Medical Dataset Imbalance

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Sophia Claudio, Jeremy Juybari

Faculty Mentor: Andre Khalil

Abstract: The rapid advances in medical digital imaging technology is fueling efforts to develop artificial intelligence tools using deep learning. These tools aim to aid the clinicians to provide more accurate diagnoses. Across deep learning, loss functions are utilized to calculate the amount of error between a model's prediction and the ground truth. This loss backpropagates across the neural network to update its weights in order to improve the model's performance. A higher loss indicates that the model predictions diverge from the ground truth, while a smaller loss means the model predictions are more aligned with the ground truth. Deep learning models for cancer segmentation face a class imbalance problem, where there are substantially fewer cancer instances than there are of noncancer. This incentivizes the model to favor the prediction of the noncancer class over the cancer class. This causes false negative predictions in a medical image context, leading to a misdiagnosis. There are established ways to handle class imbalances in machine learning, such as downsampling the predominant class or upweighting the lesser class. In this project, we explore a new way to handle this data imbalance using established loss functions to investigate how to better incorporate the segmentation errors of cancer regions.

554. KCl and MgCl Cross-linking Effect on TEMPO-Cellulose Nanofibrils

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Alexis Plater, Blake Turner

Faculty Mentor: Michael Mason

Abstract: TEMPO-cellulose nanofibrils (TCNF) are currently being explored for use as hydrogels in biomedical applications including wound healing, drug delivery, and soft tissue repair. Controlling the mechanical stiffness of these hydrogels is a key design criterion, typically achieved via chemical cross-linking. The physical characteristics of potassium and magnesium chloride-induced cross-linking of TEMPO-cellulose nanofibrils have yet to be explored, this study aimed to characterize the novel material. To do this, four experiments were performed. A "slump" test was used to determine gel deformation. Injectability was tested through a 26 gauge needle. A dye diffusion study was used to examine release kinetics from the hydrogels. Lastly, rheological characteristics were determined using a cone and plate rheometer. The data was compared to the current standard (TCNF) crosslinking methods. The results from these experiments will help to determine the efficacy of salt cross-linked (TCNF) hydrogels for injectable biomedical and veterinary applications.

555. Injectable Cellulose-Based Hydrogels for Use as an Atlantic Salmon Vaccine Adjuvant

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Blake Turner, Sarah Turner, Debbie Bouchard

Faculty Mentor: Michael Mason

Abstract: Injectable hydrogels are an established method of delivering nutrients and drugs. The Mason Lab has been exploring using TEMPO cellulose nanofibrils (TCNF) as a vaccine adjuvant and payload carrier. These CNF hydrogels exhibit desirable mechanical properties for this injectable application. After cross-linking with salt ions, the more robust hydrogels maintained their shear-thinning flow properties. This allowed the gel to be easily injected as a liquid-like material, before forming a more solid bolus inside of the organism. Calcium chloride and sodium chloride were selected for experimentation due to their known cross-linking effect on the TCNF, and relative biocompatibility at low concentrations. The salt crosslinked hydrogel formulations were found to be shear-thinning across all salt concentrations using a 40mm cone and plate rheometer. Additionally, all formulations can easily pass through a small 26-gauge needle. A 48-hour dye diffusion study was conducted, and it was determined that all crosslinked gels performed similarly, but diffused less dye than the uncross-linked TCNF. A small salmon safety trial was conducted with sodium chloride and calcium chloride formulations. No mortalities resulted after 600-degree days (DD). Some internal adhesions and edemas were noted for higher salt concentration formulations. The majority of the injected hydrogels were recovered after 600 DD. The efficacy of the formulations as an adjuvant will be examined in an upcoming salmon trial. Results from this research suggest that this injectable TCNF is a promising replacement for current oil-based aquaculture adjuvants.

556. Electronic Speed Controller for Brushless DC Motors

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Mason Bloomquist

Faculty Mentor: Jude Pearse

Abstract: I will demonstrate a circuit which can control the speed at which a brushless 3 wire DC motor spins. I will be using the same kind of motors that are found in drones and designing the speed control circuit which is used to run them. I will demonstrate what I am able to design with a running motor and some examples of where they are found.

557. Building an Ophthalmology Learning Model using Optical Coherence Tomography

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Levi Sturtevant, Kaleb Hannan, Gabriel Fitzgerald

Faculty Mentor: Terry Yoo

Abstract: In 2019, an estimated 19.8 million Americans aged 40 and older were living with age-related macular degeneration. 1 in every 20 of these patients were at risk of losing their sight permanently. The ability to detect retinal disorders early can make a significant impact on the treatments available to the patient. That is why it is so important to create tools that can help Optometrists with diagnosing patients.

As a part of our course requirement to complete COS 598 Image Processing, our group is designing and building a project using Optical Coherence Tomography. Optical Coherence Tomography(OCT) is a type of retinal imaging system that utilizes light waves to take cross-sectional images of the retina. OCT is used to help diagnose a number of eye disorders including Macular Hole, Macular Edema, Age-Related Macular Degeneration(AMD), and various types of retinopathy.

Our group's goal is to train a machine learning model based on an open source collection of OCT images with various disorders from the OPENISPCR. The model should recognize and detect images showing possible retinal disorders with moderate accuracy as well as be able to differentiate between a healthy eyeball and a diseased eyeball.

In the wake of this AI boom the world finds itself in, it is important to take advantage of tools at our disposal. With the use a Machine Learning model, computers can make the best statistical delineation from all of the data it was trained on. Our proposed technology could help automate the diagnosing process and assist Optometrists in helping patients who suffer from retinal eye disorders.

558. Development of a Thin-Film Reactor for the Synthesis of Atomically Precise Graphene Nanoribbons

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Adam Dugre

Faculty Mentor: Tomas Marangoni

Abstract: In today's tech-driven world, electronic devices have become part of our daily routines. However, technological progress is slowing down due to the miniaturization limitations, which restricts how small we can make electronic components through conventional methods. Researchers have been tirelessly exploring new materials to overcome this barrier. Among them, graphene nanoribbons (GNRs) stand out as promising candidates. In this project I have designed and assembled an apparatus for GNR synthesis under ultra-high vacuum conditions on a variety of thin film metallic surfaces. There has been a lot of learning and development on my part such as how to assemble the vacuum chamber while visualizing how components should fit together before assembly and in creating a 3D CAD model. One of the successful aspects of the reactor development saw the integration of rotary and turbomolecular pumps working in tandem to produce a rective chamber with an operative pressure of 10^-6 Torr. Automation of the precursor deposition rate was achieved via programming a temperature control unit to monitor evaporation temperatures.

In its basic operation, this reactor works by using hydrocarbon precursors which are heated in the reactor until evaporation and condense on a reactive substrate above it. On these substrates the graphene nanoribbons will be formed by surface mediated reaction. Early tests and results have been able to verify the functioning of the chamber to correct pressures and evaporation of chemical precursors given by Dr. Marangoni. This research was supported by the Center for Undergraduate Research (C.U.G.R.)

559. Thermoelectric Generators for Energy Scavenging Sensors in High-Temperature Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Ekaterina Khmeleva

Faculty Mentor: Mauricio Pereira da Cunha, Nuri Emanetoglu

Abstract: Wireless sensors using active components for operation at high temperatures (HT, > 300C) require powering systems also capable of withstanding such environments. An attractive option for biasing HT silicon carbide (SiC) transistor circuits is to use thermoelectric power generation (TEG) modules. These modules are capable of operating in harsh environment themselves, together with the circuits, thus enabling self-powered systems. The TEGs rely upon the Seebeck effect to generate a differential voltage between cold and hot sides by employing P and N doped materials capable of working in the desired environment. In this work a TEG is under design, fabrication, and test to operate up to 350C using BiTe as the thermoelectrical material, and without any active cooling on the cold side. To implement the TEG cells, commercially acquired N and P doped BiTe were cut into cubes of approximately 5 mm by 5mm, and then soldered with a high-temperature solder to copper electrodes. Under exposure to heat on a hot plate without using active cooling, a single fabricated BiTe TEG cell provided a voltage output between 6 mV to 9 mV over hot side temperature range between 100C and 300C. These cells need to be connected in series and parallel to generate the voltage and power levels needed for the circuits.

560. Life Cycle Assessment of Rubberized Pavement: An Integrated Approach for Sustainable Road Infrastructure

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Pratibha Sapkota

Faculty Mentor: Reed Miller

Abstract: Globally, organizations such as the World Road Association and the International Road Federation are advocating for sustainable road infrastructure solutions, with a particular focus on tire waste management. This emphasis is critical, given the environmental impact associated with discarding approximately 242 million tires annually in the US alone. Discarded tires pose significant environmental problems, including contributing to landfill overflow, providing breeding grounds for mosquitoes, and increasing fire hazards. These organizations promote recycling and the use of rubberized pavement as innovative solutions to mitigate these issues. This study evaluates rubberized asphalt, a material incorporating recycled tires, for its environmental benefits in road construction through a Life Cycle Assessment (LCA). It compares rubberized pavement to traditional asphalt, considering production, usage, and end-of-life, using the TRACI methodology and a sensitivity analysis on variables like pavement lifespan and recycling rates.

Preliminary results show rubberized pavement reduces waste, improves resource efficiency, and lowers greenhouse gas emissions, offering better durability and reduced maintenance compared to conventional asphalt. However, it highlights environmental drawbacks, such as its energy-intensive production and challenges in rubber material handling. The findings aim to advance sustainable road construction practices, encourage innovation in recycling, and influence future infrastructure standards.

561. Lobster Trap Acoustic Recorders for Broadscale Right Whale Detection

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Ethan DeMoura, David Peitz, Michael Schmitt, Jack Leys

Faculty Mentor: Nuri Emanetoglu

Abstract: The potential risk of critically endangered North Atlantic Right Whales becoming entangled in lobster trap gear in the Gulf of Maine is an ongoing concern. Due to the high cost of commercial monitoring equipment, the large surface area of the Gulf, and unreliable fisheries data, much of the area of concern for right whales remains unmonitored. A low-cost monitoring system, that consists of two modules, to be used collaboratively with the lobster industry for broadscale deployment, is being developed in this project. The collected data could be used to keep track of migration patterns to ascertain locations where lobstering does not interfere with whales. The first module is an underwater acoustic monitor (AM) device, consisting of a hydrophone, a microcontroller, and a custom circuit for data storage and power management, all housed in a waterproof case. This sensor detects the acoustic waves sent out in whale calls as well as any other present acoustic noise. Analyzing the patterns and frequency of the data collected could determine if any whales were detected within the range of the hydrophone and what species was detected. The second module is a base station designed to wirelessly charge and collect data from the (AM) device once it has been recovered. First-generation prototypes were constructed and deployed. The AM device demonstrated a detection range of up to 2km, and the base station was capable of charging the system at 500mA. The next generation AM has been designed to extend the detection range to beyond 10 km.

562. Additive Manufactured Biomaterial Microscopy

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Brett Palmer, Tristan Cilley, Nicholas Jacobs

Faculty Mentor: Terry Yoo

Abstract: In biomaterials such as Wood-Plastic composites (WPC), fibers are incorporated into a polymer matrix to enhance the material's mechanical properties. Understanding the distribution, density, and orientation of these fibers is an essential component of assessing a biomaterial's structural integrity. At the Advanced Structures and Composites Center at the University of Maine, Scott Tomlinson is seeking an automated method of analyzing images of cross section slices of additively manufactured material. Given high quality images from his laboratory, our group strives to develop a program that provides him with an analysis of the fibrous orientation of his biomaterials. In order to provide reliable findings, our program must account for noise such as air bubbles and imperfections that could be mistaken for fibers. Our objective is to develop a program that will provide Scott with easily understandable metrics and visuals for the fibrous orientation of materials based upon images.

563. Novel Material Extrusion Process For Additive Manufacture Of Greensand Molds

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Augustus Hoy, Eric Mabry, Samuel Morris

Faculty Mentor: Philip King

Abstract: From the bronze age to the information age, advances in metal casting techniques enabled the production of parts crucial to the defining technologies of each era. More recently, advances in additive manufacturing (AM) technology for ceramic printing has created the potential for extruded greensand molds. The novel Additive Manufacturing Greensand Casting (AMGC) technology will further evolve metal casting to meet modern challenges by combining the sustainability of classic greensand casting techniques with additive manufacturing processes. AMGC can reduce lead times for cast parts and reduce the total amount of machinery involved in the casting process, all while maintaining the sustainable nature of greensand casting. Scientific or military teams removed from standard supply chains can use recycled metals and molds produced with AMGC for rapid replacement of job critical components. An analysis of a classic greensand casting mold recipe and foundry sand particle classification by digital microscopy was used to create a full-factorial experimental design to determine the proper over-hydration and clay content necessary for extrudable AMGC sand. The shrinkage, warping, and fracture due to a necessary dehydration of the printed AMGC molds were examined to increase understanding of the complex dynamics of the AMGC process. Initial results show that parts can be cast successfully using this process, but do not yet possess equivalent properties to traditional green sand castings. Future research will investigate supplemental binding agents and the mechanics of mold dehydration to further improve AMGC.

564. OrbTak Mission Planner

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jason Kulinski, Maximilian Hillgraf, Brandon Loveland, Oliver Hild, Evan Hamer

Faculty Mentor: Laura Gurney

Abstract: In partnership with Orb Aerospace, founded by Alexander Taylor in 2017 with the vision of creating the world's largest humanitarian air force using autonomous aircraft, the Logic-Gate team is developing the OrbTAK Mission Planner. This transformative project aims to revolutionize humanitarian aid by efficiently managing and visualizing data for drone-based missions. The application is designed to optimize response times, boost mission success rates, and ultimately save lives through streamlined management and visualization of drone flights. Leveraging trusted open-source technologies such as Vue.js for UI development, Firebase for database management, and Cesium for GIS applications, our team ensures the application meets the urgent needs of delivering medical supplies and emergency services to remote locations worldwide. The OrbTAK Mission Planner serves as a critical lifeline for underserved/conflict regions lacking immediate access to essential healthcare supplies.

565. Study and Enhancement of Wild Blueberry Harvester Efficiency: A Design and Manufacturing Approach

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Nirav Mehta

Faculty Mentor: Bashir Khoda

Abstract: This study aims to enhance the efficiency and sustainability of wild blueberry harvesting in Maine by mitigating fruit loss and minimizing debris through a multi-objective optimization approach. The methodology involves the development of a novel force model, which is validated using finite element analysis (FEA), to assess and improve harvesting teeth design. This model considers factors such as detachment force and berry damage, leading to the optimization of reel speed and header speed to reduce fruit loss and debris by up to 80% without compromising berry quality. Results demonstrate that shifting from excessive pull force to effective shear force and redesigning harvesting teeth significantly reduces berry loss during picking, while controlling header and harvester speed is crucial for minimizing loss and preventing berries from being left behind. The discussion underscores the benefits of integrating the novel force model with FEA, providing insights into mechanical stresses and enabling comprehensive improvements in harvesting efficiency and berry quality. This research contributes to sustainable wild blueberry cultivation in Maine, aiming to reinforce its agricultural significance and enhance economic outcomes for farmers and stakeholders.

566. Which Privacy Concepts Do Developers Struggle With?

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Theodore Brucker

Faculty Mentor: Sepideh Ghanavati

Abstract: It is difficult for many software developers to preserve user's information privacy which may lead to privacy breaches. In this work, our aim is to investigate what privacy topics developers struggle with the most by evaluating various developers' forums and the dataset of the most recent fines. Our focus is on the European Union's General Data Protection Regulation (GDPR) which is one of the major privacy regulations. To achieve our goal, we first collected GDPR-related questions from popular Reddit and Stack Overflow forums. In multiple rounds, two independent annotators labeled each of these questions with the corresponding GDPR articles to identify the main focus. The annotation process underwent iterative refinement rounds to enhance the validity of the annotation, where we calculated interrater agreement and discussed how the annotation process could be improved. This dataset provides us with statistical insight into which articles were most prevalent. We also conducted a comparative analysis of the two forums and their similarities and differences, especially regarding the developers' challenges vs the users' concerns. Using the statistics gained through manual annotation, we cross-reference with a database of GDPR fines that include the articles that were violated, to understand the degree of correlation between the challenges developers face in protecting users' privacy and the fines received in the European Union. The study acknowledges potential limitations in generalizability due to the forum sources selected through our method. We discovered that there are clear outliers amongst the GDPR articles where developers are struggling to meet compliance.

567. Fabrication and Test of Capacitors for High-Temperature Operation

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Michael Schmitt

Faculty Mentor: Mauricio Pereira da Cunha

Abstract: Capacitors capable of operating at high temperatures up to 500 °C are required for oscillator circuits used in sensor applications operating at such temperatures. For applications at temperatures greater than 200 °C, commercial capacitors are expensive and very limited in capacitance values. In this work, capacitors ranging from 5 pF to 300pF and capable of operation at high temperatures have been fabricated and tested up to 450 °C. The capacitors were designed and simulated at the UMaine microwave laboratory, manufactured at FIRST facilities using a thick film screen printing process, and measured at the UMaine harsh-environment microwave laboratory. The properties of these capacitors (capacitance, quality factor/dissipation factor) were measured across a range of from room temperature up to 450 °C, using cycled temperature profiles.

This work was supported by DOE award DE-SC0021981

568. Evaluating Privacy Perceptions, Experience, and Behavior of Software Development Teams

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Maxwell Prybylo

Faculty Mentor: Sepideh Ghanavati

Abstract: With the increase in the number of privacy regulations, small development teams are forced to make privacy decisions on their own. In this project, we conduct a mixed-method survey study, including statistical and qualitative analysis, to evaluate the privacy perceptions, practices, and knowledge of members involved in various phases of software development (SDLC). Our survey includes 362 participants from 23 countries, encompassing roles such as product managers, developers, and testers. Our results show diverse definitions of privacy across SDLC roles, emphasizing the need for a holistic privacy approach throughout SDLC. We find that software teams, regardless of their region, are less familiar with privacy concepts (such as anonymization), relying on self-teaching and forums. Most participants are more familiar with GDPR and HIPAA than other regulations, with multi-jurisdictional compliance being their primary concern. Our results advocate the need for role-dependent solutions to address the privacy challenges, and we highlight research directions and educational takeaways to help improve privacy-aware software development.

569. Crystal Oscillator Circuit Design for Harsh Environments

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Emily Currie

Faculty Mentor: Mauricio Pereira da Cunha, Nuri Emanetoglu

Abstract: Sensors built for harsh environment wireless applications require circuits, including crystal oscillators, which can operate over a wide range of temperatures. However, critical circuit components such as transistors and crystals have temperature dependent behaviors that can compromise the operation and performance of these circuits over temperature ranges of several hundred °C. To build sensors capable of operating under these conditions it is necessary to characterize circuit components at elevated temperatures and design circuits that minimize or compensate for these effects. In this work a GaN-based quartz crystal oscillator was designed for operation from room temperature up to 400°C, targeting future usage in harsh environments as a wireless transmitting sensor platform. Commercially available GaN high electron mobility transistors (HEMT) and quartz crystal microbalance (QCM) components were chosen for the circuit and characterized up to 450°C and 400°C, respectively.. The transconductance (gm) of the GaN transistor and the equivalent circuit parameters of the crystal were extracted from measurement data and used to study the performance of several different crystal-based oscillator circuit topologies at high temperature. In simulated results, one of the Pierce oscillator topologies shows 42% amplitude consistency between room temperature and 350°C, while another Colpitts oscillator topology showed the capability of sustained oscillation with crystals of lower quality factor. This work was supported by DOE award DE-SC0021981.

570. Privacy Stories

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Wilder Baldwin

Faculty Mentor: Sepideh Ghanavati

Abstract: An increasing frequency in privacy breaches, brings the need for tools and frameworks for using new technologies to aid software and privacy engineers in developing and understanding privacy preserving software and AI. Many of the current approaches focus on privacy compliance after the application is developed. Our goal is to identify privacy-related requirements prior to development of the applications. Thus, in this project, , we investigate the capabilities of large language models (LLMs) to supplement developers' understanding of privacy by design concepts to identify and extract privacy behaviors from various software documentations. We develop a methodology for generating requirements regarding collection, usage and sharing of personally identifiable data as privacy stories. We extend a taxonomy of privacy behaviors over an initial dataset of privacy policies and use this dataset to leverage various LLMs through prompt engineering approaches to identify relationships between privacy behaviors in documentation that can be used to generate privacy stories and suggest privacy by design concepts as privacy solutions for their application. We also explore how to evaluate the rational and usefulness of natural language outputs from LLMs, and how to structure this evaluation to create more data for the refinement of these tools.

571. A QGIS Plugin for Real-Time Data Streaming

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Matthew Brown

Faculty Mentor: Silvia Nittel

Abstract: Geographical Information Systems (GIS) are systems that are widely used for spatial data analysis. The current paradigm within GIS relies on both files and databases in order to visualize static spatio-temporal data. However, within the last decade, real-time sensor data streaming has become both more prevalent and more popular, and users are interested in analyzing such dynamic data in real-time. This has led to an architectural conflict within GIS. Currently, a GIS does not have the ability to process real-time data, meaning there is not an ability to map real-time phenomena, such as environmental events. Thus, the goal of my research is to build a prototype plugin for streaming, interpolation, and analysis of real-time data within QGIS, a commonly used GIS application. I plan on accomplishing this through exploring a historical fire event, such as the California Route Fire. Specifically, I will take the sensor data from the area of the fire over the time the fire occurred, stream it through Apache Spark, window the data using previously developed algorithms, and then interpolate and visualize the streamed data into QGIS. The end result of this research will be a plugin for QGIS that will take streamed data as an input, and will produce time-defined layers in QGIS as output. This plugin will allow non-programmers to easily interact with streamed data within QGIS.

572. Advancing Metal Casting with Additive Manufacturing

Submission Type: Exhibit

Submission Category: Engineering and Information Sciences

Author(s): Eric Mabry Jr., Gus Hoy, Samuel Morris

Faculty Mentor: Philip King

Abstract: Metal casting is an integral part of the manufacturing sector as it allows the creation of near-net-shape durable, high-performing parts. The traditional casting process is well-suited for mass production, however, for small production volumes, casting is often financially unfeasible due to the high upfront cost of tooling. To address this problem, in the last 20 years, researchers have developed a process called Rapid Sand Casting (RSC). RSC combines additive manufacturing with sand casting to produce intricate mold geometries not possible using traditional methods and that do not require tooling. This process has drawbacks with the toxic gasses it produces during metal pouring and the lack of reusability. To address this problem, I have been working to develop a printhead capable of extruding a non-homogenous mixture that contains suspended sand particles of varying sizes to produce molds suitable for sand casting. This will allow for rapid production of metal casting molds with geometries that are impossible to recreate with traditional sand molding techniques and will allow the mold material to be recycled for future castings. While other printers exist that can print pastes and clays, they have limitations. The printer designed through this research project overcomes these limitations. The material reservoir is detached from the printhead unlike many other non-homogenous printers allowing for quicker replacement of material upon running out and scalable reservoir size. The auger is custom-designed to remove air from the mixture while withstanding the stresses induced from forcing the mixture through a narrow nozzle. Once fully developed, this technology will facilitate small-batch cost-effective production of metal parts, while also being scalable for larger applications when compared to other additive-manufacturing metal solutions available on the market.

573. Data Driven Innovations in Wild Blueberry: Agriculture 4.0

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Fatin Ishraq

Faculty Mentor: Bashir Khoda

Abstract: Wild blueberries rank as Maine's second-largest crop by production value, with the state's industry contributing most wild blueberries grown in the United States. This research introduces a data driven automation tool for the wild blueberry harvesting systems to augment the productivity of the operator, enhance efficiency of the harvester and support the quality of the blueberry. Leveraging the convolutional neural network model, the system was trained and optimized for detecting wild blueberries from images collected by camera mounted on drone and harvester. The resulting model successfully distinguished berry quality suitable for harvesting with 78% accuracy. The model has been utilized to generate meta-data as graphs for further analysis, suitable for applications like harvesting planning, identifying maturity stage, irrigation, fertilizer and pesticide planning. Our proposed research can assist growers to evaluate field data and make informed decisions with better economic outcomes.

574. Creating an Interpretable Deep Learning Model to Identify Species using Environmental DNA Sequences

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Samuel Waggoner, Tristan Zippert

Faculty Mentor: Chaofan Chen

Abstract: This research aims to develop an interpretable and fast machine learning (ML) model for identifying species using environmental DNA (eDNA). eDNA is a technique used to detect the presence or absence of species in an ecosystem by analyzing the millions of DNA sequences that animals naturally leave behind in water or soil. Using traditional database comparison for species classification can be a bottleneck for speed. One solution is convolutional neural networks (CNNs), which can be 150 times faster. CNNs, which have been successful with images, are used by reframing the DNA sequences as one-dimensional pictures with four channels. Then, 1D convolutions are used to condense relevant information. The interpretable model considers both the original input and the processed input while making its decision. The network is interpretable because it learns particular patterns of bases, called prototypes, that distinguish species. Humans are able to easily see the reason for any given prediction by looking at the class of the prototype that contributed most strongly to the prediction. Our non-interpretable backbone network achieved 98.4% micro accuracy, and a perfect f-1 score. We are currently adjusting the interpretable model's hyperparameters to achieve a similar accuracy. This work will contribute to the field of environmental monitoring and conservation efforts by providing a more efficient, understandable, and accurate method for native and invasive species identification.

575. Exploration of the use of Cellulose Nanofiber Powder to Staunch Blood Loss via Hydrogel Formation

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Isaac Plourde, Siamak Shams Es-haghi

Faculty Mentor: David Neivandt

Abstract: For many traumatic injuries, severe blood loss is critical to halt rapidly and efficiently. Bandages such as gauze are a simple way to quickly limit blood loss, however, they are bulky to carry and blood coagulation results in the solidification of the exudate within the matrix of the bandage. Redressing of the injury often results in the removal of the stiff, solid material embedded within the bandage, and the reopening of the wound. A need therefore exists for a compact, readily deployable, non-integrative, and nontoxic means to staunch blood and fluid loss from a wound that would enable non-destructive redressing. It is hypothesized that a powdered material which would form a gelatinous structure upon exposure to exudate would staunch fluid loss but remain non-integrated and compliant. It is proposed that powdered cellulose nanofiber (CNF) may potentially serve this function since aqueous slurries of the material form highly viscous gels at very low weight percent solids. To test the viability of employing powdered CNF as a gel-forming bandage, dried CNF will be reconstituted with water, and the viscosity of the resultant gels measured. Specifically, CNF produced by three different drying methods (spray drying, freeze-drying, and high-shear drying) will be assessed for their gel-forming capabilities post-rehydration.

576. MOF-laden 3D Printed Monolithic Filter Design and Manufacturing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Akhter Zia

Faculty Mentor: Bashir Khoda

Abstract: Recently, 3D printing, an additive manufacturing method with immense potential, has gained notable traction. This technique enables the gradual addition of fused materials layer by layer, facilitating the creation of intricate structures with ease. Moreover, it offers the flexibility to incorporate multiple materials concurrently within a single structure, thereby reducing both production time and costs. The adaptability of 3D printing has spurred its adoption across various sectors, including nanotechnology. In nanotech, tailoring the 3D printing process to achieve specific patterns or designs is imperative for desired outcomes, driving continuous efforts to refine the technology. Researches have been homed in on adjusting manufacturing parameters to assess their impact on the mechanical properties of 3D-printed products, with parameters like raster width, angle, and printing speed identified as influential factors, particularly affecting the strength of printed items. An intriguing development in 3D printing's application in nanotechnology involves integrating the synthesis of metal-organic frameworks (MOFs) into 3D-printed porous structures, opening up new possibilities, notably in fields such as water treatment. This study examines the synthesis of Cu-based MOFs on 3D-printed porous PLA structures, exploring various raster angles and air gaps. It was found that reducing the air gap and employing lower raster angles enhance MOF growth, while the opposite effect occurs with higher air gaps. MOF dispersion peaks with increased air gap before declining. By optimizing manufacturing parameters, maximal MOF availability can be achieved, thus enhancing adsorption performance for water treatment.

577. Investigation of a High-Temperature Normal-Mode Helical Antenna Implementation for Use in Wireless Sensing

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Conlan Taylor

Faculty Mentor: Mauricio Pereira da Cunha, Nuri Emanetoglu

Abstract: Presently, there exists a substantial need across numerous industries for low-profile, minimally invasive sensor devices to monitor systems and processes in high-temperature environments between 300 and 1000 degrees Celsius. Current technologies largely relying on conventional semiconductor-based electronics fail under temperatures approximately greater than 150 degrees Celsius, warranting exploration of more robust options. To this end, certain types of piezoelectric surface acoustic wave (SAW) devices have proven invaluable due to their resistance to high temperatures and reasonable integrability in passive sensors. Previous work has demonstrated that electrically small normal-mode helical antennas (NMHAs) may be designed for compactness, omnidirectional radiation, and compatible impedances and bandwidths for matching to a SAW device to fabricate a passive VHF to UHF interrogative sensor. However, previous designs and feeding structures have not explored the implementation of this antenna solution with materials capable of operating under temperature above 300 degrees Celsius. In this work, a revised NMHA design with feeding structure is proposed to be integrated with a langasite SAW resonator for operation up to 800 degrees Celsius. Impedance, resonant bandwidth, and radiation pattern of the NMHA are studied through simulations for the proposed high temperature NMHA implementation.

This work was supported by DOE award DE-SC0021981.

578. Characterization and Optimization of a High-Temperature Pierce Oscillator Circuit

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Jude Zanoni

Faculty Mentor: Nuri Emanetoglu

Abstract: Machines operating in high temperature (HT) environments are common in industries from manufacturing to oil drilling. Sensors capable of monitoring such equipment in-situ are essential to avoid catastrophic failures. This work reports on the second generation of a simulated, fabricated, and tested Pierce oscillator circuit capable of operating up to 250C optimized for less signal distortions and longer lifetime when compared to the version reported last year (2023). The circuit uses a silicon-carbide (SiC) based metal-oxide-semiconductor field effect transistor (MOSFET) common source amplifier and an LC resonant tank circuit. The HT components were either purchased or custom manufactured with temperature-resistant materials. The circuit was fabricated using thick-film screen-printing on an alumina substrate using gold paste, and the components were wire-bonded with 1 mil gold wire. The improved layout for the 2nd generation circuit was designed to minimize ground and power rail noise. The overall size of the circuit was reduced by 44% via a spiral inductor redesign. The aluminum bondpad SiC MOSFET used in the original prototype was replaced with a new SiC MOSFET with gold bondpads, allowing wirebonds to survive up to 500°C. The new circuit version was found to oscillate at 3.81 MHz with an amplitude of 6.2 Vpp at 5V RT. Maximum ground rail noise dropped from 450 mVpp to 50 mVpp and power rail ripple dropped from 350 mVpp to 160 mVpp with respect to the previous version.

This work was supported by DOE award DE-SC0021981

579. Life Cycle Assessment of Cellulose Excelsior and Cement Composites

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Maedeh Orouji, Eric Landis

Faculty Mentor: Reed Miller

Abstract: This study presents a comprehensive Life Cycle Assessment (LCA) of a novel composite material consisting of cellulose excelsior (wood fiber) and reduced amounts of cement. The primary objective is to evaluate the environmental impacts of this composite, with a particular focus on minimizing the use of cement. Given the high energy consumption and carbon emissions associated with cement production, this research aims to leverage the sustainable attributes of cellulose excelsior, a renewable and biodegradable material, to offset the environmental footprint of the composite. The LCA explores the balance between maintaining the structural integrity of the composite and reducing its overall environmental impact by optimizing the cement content. The findings of this study are expected to contribute to the development of more sustainable construction materials, aligning with the principles of green building and circular economy.

580. Visualization of Structural Monitoring Data for the Penobscot Narrows Bridge

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Zachary Scott, Andres Vargas, Alexander Bourgoin, Tyler Harwood, Nicholas Dieffenbacher-Krall

Faculty Mentor: Laura Gurney

Abstract: In 2007, Dr. Keith Berube, Dr Roberto Lopez-Anido, and Vincent Cacceese from the University of Maine launched the Integrated Monitoring System for Carbon Fiber Composite Cables in the Penobscot Narrows Bridge Research Initiative. This initiative sought to implement a monitoring system for six carbon fiber composite cables (CFCC) on the Penobscot Narrows Bridge (PNB), tracking their corrosion resistance compared to epoxy-coated steel cables, and reduce the $276 billion the U.S. spends on infrastructure maintenance. While monitoring systems have been installed on the bridge, the data was not easily accessible until Team ZATAN made a public facing web portal allowing for the visualization and download of the collected data. Team ZATAN worked with Dr. Berube to elicit software requirements and produce comprehensive documentation in accordance with a hybrid development methodology based on the Waterfall, Spiral, and Scrum models. The web portal was designed to facilitate the download and visualization of monitoring data from the PNB, prioritizing accessibility for the general public in addition to the Maine Department of Transportation. Finally, supplemental documentation such as an administrator manual and a user guide were created to ensure the longevity of the product. This data could exhibit that carbon fiber is a more economical building material. It may eventually be used for future research, educational purposes, and to reduce maintenance costs related to rust and corrosion for all taxpayers.

581. Unlocking the Cellulose Domain: A Methodological Framework for Ontology-Based Property Entity Construction

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Xuelian Zhang

Faculty Mentor: Torsten Hahmann

Abstract: This paper summarizes the novel proposal on the updated methodology that will take into account the information resource, information extraction technology, and changes in routines for building ontology of properties related with cellulosic materials. It also provides a framework for domain scientists to construct and extend various ontologies within their own research interests and promote knowledge fusion of various aspects of cellulosic materials. Moreover, it can be useful in developing a comprehensive ontology colony about properties of all materials and serve as a practical reference for ontology development within the whole materials science domain.

582. Characterizing Stability of Bulk Nanobubbles in Micro-gravity Using Dynamic Light Scattering

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Arman Kiani

Faculty Mentor: Ali Abedi

Abstract: We aim to explore the utilization of Nanobubbles (NBs) within aerospace life-support applications, focusing on their unique properties, including prolonged stability lasting from hours to months. It is possible to develop energy-efficient water treatment systems and biological algae generating reactors by using NBs. The analysis of NBs in constrained environments, such as CubeSats, presents numerous challenges due to space and power limitations. Compared to other techniques, dynamic light scattering (DLS) was found to be the most effective method for tracking NBs in this setting. DLS is one of the most popular techniques for the particle size distribution (PSD) to determine particles under Brownian motion. In the UMSS presentation, we focus on the power consumption, cost, and size of the DLS system. In addition, detailed discussions will be provided on the key components of our novel CubeSat DLS system, including laser diodes, an Avalanche Photodiode (APD) detector, and a correlator.

583. Wireless Propagation Models for Near Ground Antennas and Investigating Penetrated Signals Through Tree Trunk

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Mersedeh Najishabahang

Faculty Mentor: Ali Abedi

Abstract: This research provides an overview of different approaches to modeling radio wave propagation in forested areas. It examines both empirical and analytical studies in electromagnetic wave propagation to support the optimization of wireless sensor networks in challenging forest environments. The study discusses and evaluates traditional propagation models, as well as newer approaches that build upon these models. It categorizes analytical models, which are physics-based descriptions of wave propagation, into two main types: geometrical optics and dielectric analysis. Recent advancements and refinements to traditional models are also reviewed. Additionally, the research explores the impact of electromagnetic waves passing through trees and bushes. Trees, being living organisms with layers of water, wood, and fiber, affect the signal that penetrates them, potentially causing power reduction or fluctuations, which will be investigated in this study.

584. Analysis of Hybrid Hydrogel Scaffolds for Post-bioprinting Density Variation of 3D-printed Chlorella Microalgae Cells

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Olubusuyi Ayowole

Faculty Mentor: Bashir Khoda

Abstract: Green bioprinting is a promising technology that involves the use of 3D bioprinting to create an organized molecular arrangement of green plant cells within an engineered tissue. Investigating the post-bioprinting cell growth density variation of microalgae in scaffolds of hybrid hydrogel biomaterial is crucial to the optimization of the bioproduction of algae cells at an industrial scale.

This study focuses on a blend of nanobiotechnology and micro-biofabrication to adopt a phototropic approach towards understanding and influencing the post-fabrication behavior of microalgae-based bioinks upon their subjection to the mechanical forces associated with micro-extrusion during 3D bioprinting. The focus of this research project is not on the aesthetics of the bio-printed constructs, but on the effect of mechanical forces on the morphology and proliferation of chlorella microalgae cells after bioinks seeded with the cells have been subjected to bioprinting by proxy, owing to the existence of cell suspensions in the bioinks.

Based on their scaffolding capabilities on record, three hydrogel biomaterials strategically adopted to form bioinks substrates in this study are Alginic acid sodium salt (ALGINATE), Nanofibrillated Cellulose (NFC) – TEMPO, and CarboxyMethyl Cellulose (CMC). Two sets of bioinks are developed to investigate how much substrates made of individual, or hybrid hydrogel compositions boost or dampen cell proliferation and morphology when cell suspensions are introduced to the substrates to make the bioinks. The growth pattern for chlorella microalgae cells within the different hydrogel compositions is extensively investigated using periodical absorbance values of the bioinks. The shear thinning properties of the hydrogel compositions are also investigated using viscosity and shear stress data of the hydrogel substrates.

NFC was found to exhibit a lower shear thinning capacity at higher shear strain rates in comparison to CMC. At a shear strain rate of 70.8 s-1, the viscosity of 2% CMC w/v and 1% NFC w/v were obtained as 2.27 Pa.s and 0.41 Pa.s respectively, whereas at a shear strain rate of 0.1 s-1, the viscosity of 2% CMC w/v and 1% NFC w/v were obtained as 28.34 Pa.s and 48.30 Pa.s respectively. The absorbance values obtained for mono-hydrogel substrates used for bioink production were 0.04, 0.06, 0.014, and 0.61 for 1% Alginate w/v, 2% Alginate w/v, 2% CMC and 1% NFC, respectively. The trends observed in the periodical variation of absorbance values have been interpreted to mean that for the hydrogel substrates with significant adhesive

properties, a higher absorbance value at a wavelength of either 450 nm or 650 nm translates to a dampening tendency on the growth of the chlorella microalgae suspension within a bioink formulation.

585. Multi-Fidelity Surrogate Modeling for Additive Manufacturing Applications

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Troy Zangle

Faculty Mentor: Masoud Rais-Rohani

Abstract: Additive manufacturing (AM) is rapidly transitioning from small‐scale prototype development to large‐scale production manufacturing. With this change additive manufacturing is requiring accurate performance prediction through simulation modeling to assess the structural properties of the resulting parts that can account for the complex manufacturing process. However, direct physics modeling of a part in this situation can be prohibitive for exploring the full design space of the part in the design stage. Additive manufacturing provides a data-rich environment that can be leveraged to inform data-driven models. An approach known as multi-fidelity surrogate modeling (MFSM) is being investigated towards this end in this research. MFSM can combine data from sources of varying quality, such as experimental data (high-fidelity) and a simplified physics-model (low-fidelity), to produce an accurate model of the design space at an acceptable computational cost. This work goes over the MFSM of cokriging and applies it to standard analytically defined multi-fidelity data sets.

586. Well-calibrated Uncertainty Quantification in Neural Networks for Barriers-based Robot Safety

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Masoud Ataei

Faculty Mentor: Vikas Dhiman

Abstract: Recently, uncertainty-aware controllers that guarantee safety have been proposed in the literature. Among such controllers, Control Barrier Functions (CBFs) based approaches are popular because they are fast yet safe. However, most such works depend on Gaussian Processes (GPs) or MC-Dropout for learning and uncertainty estimation, and both approaches come with drawbacks; GPs are non-parametric methods that are slow, while MC-Dropout regression outputs are noisy. On the other hand, modern Bayesian learning algorithms have shown promise in uncertainty quantification.

The application of modern Bayesian learning methods to CBF-based controllers has not yet been studied. We aim to fill this gap by surveying uncertainty quantification algorithms and evaluating them on CBF-based safe controllers. We find that model variance-based algorithms (for example, Deep ensembles, MC-dropout etc.) and direct estimation-based algorithms (such as DEUP) have complementary strengths. Algorithms in the former category can only estimate uncertainty accurately out-of-domain, while those in the latter category can only do so in-domain. We combine the two approaches to obtain accurate estimates both in- and out-of-domain. As measured by the failure rate of a simulated robot, this results in a safer CBF-based robot controller.

587. Sparse Hierarchical Representations for Fast Optimal Control

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Elvis Gyaase

Faculty Mentor: Vikas Dhiman

Abstract: For robotic navigation, the methods of environmental representations can be categorized as topological (sparse) and metric (dense) representations. We focus on topological mapping because they are able to represent a large area with a small memory footprint. Furthermore, topological representations can be easily arranged hierarchically to combine different types of representation at different levels of abstraction. Although they are primarily spatial representations, several works show that semantic and causal information can be included in this hierarchy. We present a review of literature in this area, and the open challenges with application to robot vision navigation.

588. Omobot: A Low-cost Mobile Robot for Autonomous Search and Fall Detection

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Shihab Uddin Ahamad, Masoud Ataei

Faculty Mentor: Vikas Dhiman, Vijay Devabhaktuni

Abstract: Detecting falls among the elderly and alerting their community responders can save countless lives. We design and develop a low-cost mobile robot that periodically searches the house for the person being monitored and sends an email to a set of designated responders if a fall is detected. In this project, we make several novel design decisions and contributions. First, our custom-designed low-cost robot has advanced features like omnidirectional wheels, the ability to run deep learning models, and autonomous wireless charging. Second, we improve the accuracy of fall detection for the YOLOv8-Pose object

detection network by 6%. We do so by transforming the images captured from the robot viewpoint (camera height 0.15m from the ground) to a typical human viewpoint (1.5m above the ground) using a principally computed Homography matrix. This improves network accuracy because the training dataset MS-COCO on which YOLOv8-Pose is trained is captured from a human-height viewpoint. Lastly, we improve the robot controller by learning a model that predicts the robot velocity from the input signal to the motor controller.

589. Nanocellulose Based Foams for Low-Cost Disposable Medical Applications

Submission Type: Poster

Submission Category: Engineering and Information Sciences

Author(s): Sydney Sheehan, Dominic Kugell

Faculty Mentor: Michael Mason

Abstract: Polyurethane (PU) foams have been a staple material for their use in medical positioners, such as post surgery elevation pillows as well as specific tailored positioners for their use during surgery. PU foams are preferred because of their lower cost, versatility, and suitable mechanical properties. However, the environmental impact, including both cost and perception, of these foams is immense. Therefore, alternatives are being explored with compostable biopolymers emerging as a promising class of materials. Cellulose is one such polymer that has recently demonstrated desirable properties. In this study, nanofibrillated cellulose (NFC), a household foaming agent, and a majority cellulose wood pulp (<88%), are combined to create a low density bio-foam. The goal of the work presented here is to develop and demonstrate a scalable green method for generating porous biodegradable cellulose based foam products. The resulting materials must be comparable with current single use PU products.

601. Selections from a Senior Recital in Vocal Performance

Submission Type: Oral Presentation - 9:15 AM, Minsky Recital Hall

Submission Category: Arts

Author(s): Chana Freedberg

Faculty Mentor: Isaac Bray

Abstract: Performing a selection from the Vocal Performance degree capstone which is a one hour senior recital, consisting of the singer along with a collaborative pianist and singing works from all major classic genres and languages of operatic music.

602. A Live Performance of Oskar Bohme's Trumpet Concerto in F Minor for Trumpet and Piano, Third Movement.

Submission Type: Oral Presentation - 9:30 AM, Minsky Recital Hall

Submission Category: Arts

Author(s): Samuel Ivey

Faculty Mentor: Jack Burt

Abstract: A Live Performance of Oskar Bohme's Trumpet Concerto in F Minor for Trumpet and Piano, Third Movement.

603. Transposing for Flute Ensemble

Submission Type: Oral Presentation - 9:45 AM, Minsky Recital Hall

Submission Category: Arts

Author(s): Ryan St. Peter

Faculty Mentor: Elizabeth Downing

Abstract: Initially, my research involved arranging a wind quartet with piano accompaniment into a flute quartet with piano accompaniment using MuseScore. I treated the arrangement more of a transposition than an actual arrangement and planned my research and observations around accuracy and timbre while using the notation software as a tool. My observations included various problems with the notation software and the music itself. In addition, I became aware of situations where one instrument better suited a section than another. The original arrangement was made for two flutes, alto and bass flutes, and piano, but after completion, one of the flute parts was omitted and replaced with the piccolo. This was done due to various octave similarities which did not sound right. A scale that occurred between one of the flutes and the alto flute was transposed into the same octave, sounding like one instrument. However, after replacing the flute with the piccolo (which brought this scale up an octave) and leaving the alto flute line as is, the octave similarity was fixed and the piece now sounds very close to the original. The bass flute had a similar problem, as it replaced the bassoon part, but this was minor, and the transposition added a nice contrary motion. I also encountered problems with the notation software, such as small percentages of the piece not saving and words and staffs not fitting on the pages properly, but all were minor adjustments. I hope to assess the effectiveness of my arrangement by performing it to the public, possibly playing the original arrangement also if time permits.

604. Weber Grand Duo Concertant Mvt.3 Performance on Clarinet

Submission Type: Oral Presentation - 10:00 AM, Minsky Recital Hall

Submission Category: Arts

Author(s): Audrey Prentice

Faculty Mentor: Beth Wiemann

Abstract: This is a piece that I have been working on throughout this semester. This was composed by Carl Maria von Weber in 1815. It is a virtuosic style piece for both the clarinet and piano.

605. Camerata Dirigo

Submission Type: Oral Presentation - 10:15 AM, Minsky Recital Hall

Submission Category: Arts

Author(s): Micah Thurston

Faculty Mentor: Laura Artesani

Abstract: Camerata Dirigo is a choral octet that was founded in 2024 by University Of Maine students to explore the intricacies of choral music through one on a part singing. Camerata Dirigo is an unconducted, undirected, collaborative music ensemble that is designed to prepare its members for professional choral and directing environments. The piece we will be performing is Frank Ticheli's "Earth Song". We have chosen this piece because of its very pertinent messaging to current events all across the world. The piece also helps spread the message that Camerata Dirigo hopes to embark on the world. Music and singing are a refuge for us all. It is our goal to inspire other musicians to follow their dreams and to create their own opportunities to spread their passion.

606. The Language of My Grandmother is a Language of Resistance: How the Matrilineal Transmission of Pisanki Expresses Cultural Identity

Submission Type: Exhibit

Submission Category: Arts

Author(s): Sarah Renée Oźlanski

Faculty Mentor: Carla Billitteri

Abstract: Pinsaki, an ancient Slavic tradition of writing talismans on raw eggs in association with springtime rituals that is still practiced today, is currently being used by members of the Slavic diaspora as an act of solidarity in support of Ukraine and a message of resistance against Russia. This tradition is a hybrid of visual and written language and is a unique and significant form of gender and cultural specific communication that has been overlooked as craft and folk art. My project has been a multidisciplinary approach to create contemporary eggs that communicate the stories of my Polish-American family, who immigrated to the United States after the Russian occupation of their homeland a hundred years ago.

My research involves knowledge from several disciplines including hermeneutics, critical theory, gender studies, and art history while adding a theoretical framework that focuses on objects of cultural memory, cultural trauma, and semiotics. Using my training in both studio art and creative writing, I have been creating pisanki on hen, duck, and goose eggs. I have combined the traditional symbols and colors of pisanki that I learned from my family with elements and principles of design from Western fine art and narrative structure from English literature and poetry. These eggs are significant to our present moment and current dialogues with regard to issues of immigration, cultural identity, cultural genocide, and war and the importance of both visual art and narrative art to raise awareness and motivate action for change.

607. The Modernist Use of The Theme of Lynching

Submission Type: Oral Presentation - 11:30 AM, Classroom A

Submission Category: Arts

Author(s): Samantha Ireland

Faculty Mentor: Carla Billitteri

Abstract: Lynching is a form of vigilante justice that results in the public execution of the accused offender at the hands of a mob or group of people. This keeps the suspected criminal from receiving due process and allows the attackers to act as judge, jury, and executioner. This was often used during the Civil War to punish those who stole horses, food, or other possessions by mob members dressed in masks in order to hide their identities. Once slaves were emancipated and the Reconstruction Era began, lynching became a way for white men to attack and kill men of color with no legal repercussions. These attackers did not wear masks as they were openly and unashamedly killing people they viewed as property and less than human. From here on, lynching became synonymous with the killing of black people.

As African American artists, writers, and activists established an identity for themselves and their art, many began incorporating the theme of lynching into their work. This was done as a way to stand up against the injustice, to spread awareness of the attacks, and to heal from the cultural trauma of the hate crime. At first, discussing a topic as graphic and horrifying to American culture as this one, people were shocked and uncomfortable with its incorporation into modern art. The discomfort was the artists' goal to bring awareness and communicate their pain. This theme has stood the test of time as African American culture continues to work through this severe injustice to their people.

608. The Legacy of Negritude in Cannibal

Submission Type: Oral Presentation - 11:45 AM, Classroom B

Submission Category: Arts

Author(s): Cameron Barone

Faculty Mentor: Carla Billitteri

Abstract: In my research, I am examining Safiya Sinclair's collection of poetry, *Cannibal*, and utilizing my understanding of the Negritude movement to identify the lasting characteristics of the movement in Sinclair's poetry. I begin by exploring the origins of the Negritude movement in France as it reaches the Caribbean through the work of Cesaire and other course texts, and the characteristics of the movement that prevail. I use the texts of Abiola Irele, "The Harlem Renaissance and the Negritude movement," Diagne Gamby Camara, "Faces of Blackness: The Creation of the New Negro and Négritude Movements in Harlem and Paris," Franklin Rosemont and Robin D. G. Kelley, "Surrealist Beginnings in the United States, 1930s-1950s" in *Black, Brown, and Beige: Surrealist Writings from Africa and the Diaspora*, and Laura Doyle, "Toward a philosophy of Transnationalism." After establishing a basis for understanding the Negritude Movement, I discuss the stylistic (surrealist) and political intentions of the movement as it existed in its conception and develop a further timeline of the movement to give readers a glimpse into the lifespan of Negritude before delving into Safiya Sinclair's work, *Cannibal*. I touch on the etymology of the word Negritude, as well as the word "cannibal" and explore the conceptual framework of opacity through double-speak. I utilize class meeting notes from November 14th, 2023 written and presented by Professor Billitteri on the concept of coding. Both *Cannibal* and Cesaire's work *Une Tempête* are informed by William Shakespeare's *The Tempest*. I utilize all three texts, situated in conversation with one another, about the depiction of black people as savages and cannibals.

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701. Lifetime Trauma as a Risk Mechanism for Hazardous Cannabis Use in LGBTQIA+ Young Adults

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Leah Cingranelli, Krutika Rathod, Patricia A. Goodhines

Faculty Mentor: Patricia A. Goodhines

Abstract: Aim: LGBTQIA+ young adults experience greater cannabis risk than cis-heterosexual peers, likely attributable to chronic minority stress. However, the association between traumatic life experiences and LGBTQIA+ cannabis use remains a critical literature gap precluding tailored intervention. This study characterized lifetime trauma and cannabis use in LGBTQIA+ and cis-heterosexual college students, exploring trauma as a risk mechanism underlying hazardous cannabis use in LGBTQIA+ young adults.

Method: Cross-sectional online survey data was drawn from 332 undergraduate students (Mage=19.04±1.39 years, range=18-25; 49% cisgender women, 46% cisgender men, 5% transgender or non-binary; 77% heterosexual, 23% LGBQIA+; 84% White, 7% Multiracial, 4% Black, 3% Asian, 1% Hispanic/Latine, <1% American Indian/Alaska Native) at a four-year university in the Northeastern U.S. Surveys assessed participant characteristics, traumatic life experiences, and comprehensive cannabis use behaviors.

Results: Cannabis use incidence and frequency did not differ by gender identity or sexual orientation in the current sample (ps=.31-.66). Specific risk subgroups for past-month cannabis use include lesbian (M=5.67±1.53) and queer (M=5.00±1.00) participants, albeit with limited sample sizes. LGBTQIA+ students reported more traumatic life experiences (M=7.65±4.45) than cis-heterosexual peers (M=4.62±3.83; t[315]=5.67, p<.001, d=.76), with notable elevations in sexual/physical violence. Mediation analysis revealed that associations of LGBTQIA+ (versus cis-heterosexual) identity with hazardous cannabis use was fully explained by an indirect effect of greater lifetime trauma experiences (95% bootstrapped CI=0.21, 1.03), after controlling for age, sex, and past-year alcohol use.

Conclusion: Although LGBTQIA+ and cis-heterosexual college students reported similar cannabis use behavior, lifetime traumatic experiences emerged as a novel risk factor for

LGBTQIA+ students. Future research should elucidate modifiable cognitive risk factors, such as coping motives for trauma-related mental health symptoms. Replication in larger samples is also exigent to explore generalizability across heterogeneous LGBTQIA+ identities. Current findings may inform the identification of at-risk LGBTQIA+ young adults and inform tailored intervention to mitigate disparate cannabis risk.

702. Community-Led Alternatives to Jail Expansion and Exploring a Needs-Based Approach Considering Mainers With Connections to Penobscot County Jail

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Abigail Miller

Faculty Mentor: Sarah Walton

Abstract: My research question is twofold: 1) What needs, (housing, healthcare, mental health services, addiction support, etc.) are left unmet within the Penobscot County community that lead to incarceration and overcrowding in Penobscot County Jail (PCJ)?, and 2) What existing non-profit organizational programming could be funded that could assist these needs, lower incarceration rates, and therefore alleviate the need for a jail expansion? On a larger scale, this research will add evidence to the conversation that jail expansion is not the answer to a large jail population. Through this research, my goal is to help communities fundamentally challenge and rethink the way we structure the criminal justice system. Funding alternative structures to incarceration would lower recidivism rates and produce a restorative system. This research offers an understanding of what needs aren't being met, what needs can be met, and how that can be achieved in order to decrease the number of people incarcerated and extend services to alleviate the need for a jail expansion. I investigated my research questions using semi-structured, in-depth interviews with participants who identified as a family member of someone who has been incarcerated at Penobscot County Jail as well as with participants who represented local non-profit organizations. Penobscot County includes a community of people who are left without housing, mental health services, healthcare, food, substance use disorder support, and community connection. There are several nonprofits that already exist to serve these needs. With more funding, organization, lived experience leadership, and collaboration, the community could be built up with accessible resources that alleviate the need for incarceration.

703. Teacher Perspectives Post Covid, Amidst Anti-Woke Policies

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Emily Hamby

Faculty Mentor: Rebecca Buchanan

Abstract: This research explores the perspectives and daily practices of PreK-12 classroom teachers. Over the last five years, classrooms have gone through significant changes between remote schools during COVID-19 and discourse surrounding new and evolving anti-woke policies. This research is investigating how teachers have responded to the dual pressures of the COVID-19 pandemic and increased political tension regarding diversity, equity, and inclusion in schools. Using an anonymous, voluntary survey posted on social media platforms, this research will collect empirical data from educators to discover what patterns might exist between aspects including educators' demographics, and perspectives on teaching in relation to how anti-woke policies and the COVID-19 pandemic are impacting their current teaching practices. The findings of this research will inform what practices to consider to improve teacher retention through improved teacher support systems.

704. Ensuring Representation of Diverse Perspectives in Maine's Climate Plan

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Louise Chaplin, Catherine Mardosa

Faculty Mentor: Sharon Klein

Abstract: Our project, led by the University of Maine Mitchell Center for Sustainability Solutions (MCSS), aims to increase participation and inclusion of Maine's disadvantaged populations in the next statewide climate plan. The Maine Climate Council and its six Working Groups are currently developing the new state climate plan, which will be released in December 2024. This is the second iteration of the 2020 "Maine Won't Wait: A Four Year Plan for Climate Action". The 2020 plan established the Equity Subcommittee; a group of researchers, community representatives, and professionals. The Equity Subcommittee submitted an official report in March 2023 outlining recommendations to the Maine Climate Council, with the goal of increasing participation of at-risk communities such as Indigenous people, people of color, low-income households, and rural communities. This research project, funded by the Governor's Office for Policy, Innovation, and the Future, is using the Equity Subcommittee's recommendations to guide outreach in communities across the state. To better base our work in community-led processes and values, we are working with organizations local to our target communities, such as the Community Organizing Alliance and A Climate to Thrive. These partner organizations will help facilitate discussions, surveys, and focus groups in our 20 target communities, in collaboration with the UMaine/MCSS team. Our work will culminate in a series of recommendations to the Working Groups, based on feedback we receive in our outreach efforts.

705. The Contribution of Recovery Community Centers toward Substance Use Recovery Outcomes

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Cynthia Cushing, Leslie Beliveau, Maia Campoamor, Elizabeth Hyde

Faculty Mentor: Jennifer Crittenden

Abstract: Recovery Community Centers (RCCs) in Maine have provided benefits for people in recovery since 2008 when the first RCC was established in Bangor; currently Maine has 19 RCCs.

RCCs provide people in recovery from substance use disorders (SUDs) with resources which may not be readily available at a clinician's office or the hospital. Services offered include peer support, recovery coaching, and assistance with finding housing and employment options.

Despite the myriad benefits of RCCs to people in Maine over the last 15 years, there are few statistics defining their effectiveness. This research project aims to answer the question: Do RCCs contribute to positive recovery outcomes in Maine?

Utilizing a statewide survey of RCCs in Maine, we asked people in recovery who are currently utilizing RCCs about their recovery from SUDs, as impacted by their affiliation with an RCC.

The survey, based on the Recovery Outcomes Matrix (ROM) questionnaire, asked respondents to answer a series of close-ended questions twice; first, through the lens of their life prior to working with an RCC, and now, as they are using an RCC as part of their recovery.

The goal of this study is to provide policy makers with evidence-based solutions for promoting RCCs and, in turn, support individuals in recovery, and family members affected by SUD. This research aimed to explore the hypothesis that individuals who utilize RCCs during their recovery journey have an increased likelihood of sustained recovery as indicated by pre and post ROM scores.

706. Loneliness but Not Social Isolation Cross-sectionally Associated with Worse Cognitive Function in Older Adults During COVID-19

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Madison Landry, Dylan Taplin, Morgan Tallman, Holly Timblin

Faculty Mentor: Rebecca MacAulay

Abstract: Objective: Social isolation and loneliness are associated with greater stress and morbidity, which may exert negative effects on cognitive function. COVID-19 promoted social isolation to reduce disease transmission, thus impacting access to social support. Although loneliness is a recognized risk factor for cognitive decline, knowledge is limited concerning the effects of loneliness as compared to social isolation on cognitive function during the COVID-19 pandemic. This study examined the interrelationships among cognitive function, social isolation, and loneliness within the context of pandemic stress in 140 older adults.

Methods: Our data came from the Maine Aging Behavior Learning Enrichment study (M-ABLE-Wave 2) collected via Zoom. The National Alzheimer's Coordinating Center (NACC) Telephone Neuropsychological battery examined verbal memory (Craft Story 21 and Rey Auditory Verbal Learning Test: RAVLT), executive function and processing speed (Oral Trails Making Test Trails A & B), and verbal fluency (Category Fluency and F-L tests). The NACC COVID-19 impact scale assessed pandemic-related social isolation and stress.

Results: Partial correlations adjusting for age found that loneliness was associated with worse immediate verbal recall, learning and list recognition, slower processing speed, delayed story recall, and semantic fluency but not phonemic fluency or delayed list recall. While social isolation was associated with greater loneliness and lower perceived control, no relationships emerged with cognitive function.

Conclusions: Loneliness, but not social isolation, was significantly associated with worse cognitive function. Our results also suggested pattern-specific findings with loneliness on cognitive function. These findings highlight loneliness as an area for potential intervention to prevent cognitive decline.

707. Understanding the Socioeconomic Barriers Facing Precariously Housed and Unhoused People

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Brenna Jones

Faculty Mentor: Ryan LaRochelle

Abstract: This research focuses on the experiences of people who have been categorized as unhoused or precariously housed. Drawing on 18 interviews with unhoused or precariously unhoused individuals in the greater Bangor area, this study analyzes the economic, social, political, and interpersonal barriers that these individuals face through an exploration of their personal histories and lived experiences. These barriers encompass not only living costs, work hours, job benefits, healthcare, credit reports, and down payments but also the stigmatization and individualization of the housing crisis and those experiencing its effects. By focusing on individuals' lived experiences and the challenges these individuals face, this study aims to humanize a segment of society that is often condemned, marginalized, or ignored. Through this investigation, the study aims to uncover how housing, employment opportunities, social policies, and community dynamics contribute to the perpetuation of precarious housing and homelessness within our society, often inadvertently exacerbating these issues.

708. The Capacity of Adolescents to Consent to Mental Health Care

Submission Type: Oral Presentation - 10:00 AM, Classroom B

Submission Category: Social Sciences and Humanities

Author(s): Cassandra Rowan

Faculty Mentor: Patricia Goodhines

Abstract: Both the American Psychological Association (APA)'s Ethical Principles of Psychologists and Code of Conduct and the United States Health Information Portability and Accountability Act (HIPAA) emphasize the role of informed consent in the delivery of effective and ethical mental health care. Informed consent, and the provisions of confidentiality that result from it, are especially relevant to youth from vulnerable populations such as sexuality and gender diverse youth who may avoid seeking services due to fears of victimization and family rejection when caregivers can freely access their treatment records. The validity of informed consent relies on the question of whether the individual possesses competence to understand and communicate their treatment decision without coercive influence. However, the age and circumstances under which states empower adolescents to provide their own informed consent vary widely, with little apparent recognition of developmental science. This study is collecting cross-sectional data on the ability of adolescents ranging from 14 to 18 years old to demonstrate the understanding, appreciation, and reasoning abilities necessary to select and indicate treatment preferences using the MacArthur Competence Assessment Tool for Treatment (MacCAT-T). These data will be used to assess adolescents' abilities to provide informed consent and to help determine when and under what circumstances adolescents can be granted authority to provide independent informed consent to outpatient mental health care. Ultimately, results of this study may be used to advocate for the expansion of treatment access and confidentiality provisions for adolescents, especially for adolescents from vulnerable populations.

709. The Social Network Diversity Index for Emerging Adults - A Preliminary Analysis

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Kathleen Duncan, Daniella Gelman

Faculty Mentor: Cynthia Erdley

Abstract: Social networks, ties to other humans, are an essential component of well-being (Cohen, 2000). Smaller social networks have been associated with all- cause mortality (Stokes et. al., 2021), highlighting social networks as a critical intervention target. Emerging adults are a critical population for social network research as they are experiencing heightened social awareness. A lack of accurate measures of emerging adults' social network size precludes targeted, relevant research. This exploratory study aimed at assessing the accuracy and scope of preliminary adaptations to the current measure of social network diversity, the Cohen Social Network Index (C-SNI; 1997) for emerging adults. A sample of 201 college students completed a revised version of the C-SNI, which contains 20 questions asking about the frequency of in person and virtual interactions during the past two weeks across different potential social groups. After, respondents listed any additional social groups not included. Quantitative analyses indicated a high degree of relevance with all listed social groups relevant for subsets of the respondents and 71.5% of respondents indicating no additional social interactions. Exploratory analyses indicated differences in measurement accuracy or social network size between gender, sexual orientation, and racial groups, with lower social network diversity sizes trending towards significance for college students who identified as Queer, Gay/Lesbian, Bisexual, Asexual Pansexual, Transgender Male, Hispanic/Latino/Latina/Latinx, or Asian/Asian American. Qualitative analyses, indicate the need for further measurement refinement with question development to assess participation in Greek life, club sports, and student government. Overall, the revised C-SNI indicates promising utility for future research.

710. Removing Gender from Medicine: An Analysis of the Limitations Enforced by the Gender Binary in Pre-Medical Education

Submission Type: Oral Presentation - 12:00 PM, Classroom B

Submission Category: Social Sciences and Humanities

Author(s): Elliott Hooper

Faculty Mentor: Lily Herakova

Abstract: Pre-medical education often understands and teaches gender as a binary, which results in future medical providers not being able to adequately care for trans* and gender-nonconforming patients (Snelgrove et al., 2012). To address this issue, I investigated current pedagogical approaches in the field of pre-med and medical education, as well as scientific and social understandings of sex and gender, to create a tool to reflect on the gender inclusivity of course curricula and classroom environments. The tool draws on and responds to existing literature on the topics of gender discrimination in healthcare, the importance of gender-diverse education, different perspectives on gender, and pre-existing social justice tools. I also conducted an autoethnographic study of my educational experiences in the pre-medical program here at the University of Maine. The self-reflective tool I designed can be used by both educators and learners to consider gender inclusivity within both course materials and classroom interactions. The tool can help improve undergraduate education, especially in the pre-medical field, to include a comprehensive understanding of gender and educate competent healthcare providers who are capable of providing quality care to all, as called for by the Center for Gender-Based Biology at UCLA, Boston University School of Medicine, and researchers with the journal of Perspectives on Medical Education (Male or Female? It's Not Always so Simple, 2015; Streed Jr. et al. 2022; Zumwalt et al., 2021).

711. Human Trafficking on the Internet: A Social Work Obligation

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Sophie Ladd

Faculty Mentor: Elizabeth DePoy

Abstract: When people picture human trafficking, many imagine Hollywood movies that highlight kidnapping and physically taking someone away. This idea of human trafficking does exist but tends to mislead people into underestimating how present human trafficking is in their everyday lives. “Human trafficking is a widespread form of modern-day enslavement,” it can take place in your community and your back pocket. Traffickers have increasingly used social media to identify, coerce, and control vulnerable populations, especially adolescents whose socialization often occurs through screen-mediated digital methods. Given the commitment of social work to promote social justice and human flourishing, the profession should therefore be leading efforts in the prevention of this heinous practice. Yet, trafficking is not only seriously underserved by social workers but also hampered by preventive strategies that do not address the critical role of social media in recruiting and controlling victims. This study trains its focus on the preparation of social workers to intervene in the sex trafficking of adolescents.

Relying on analysis of secondary data sources from a sample of undergraduate and graduate social work education curricula, this study answers the following research questions:

1. What theories of human trafficking are being taught to social work students?

2. What methods of prevention and intervention are taught to social work students?

3. To what extent are social media included in curriculum theory, prevention, and intervention strategies?

4. What are the gaps that need to be filled for social workers to be prepared to engage in contemporary-relevant trafficking prevention and intervention?

712. Effect of Environmental Policy Effectiveness on Industrialization in Developing Countries

Submission Type: Oral Presentation - 10:00 AM, Classroom A

Submission Category: Social Sciences and Humanities

Author(s): Solomon Agbesi

Faculty Mentor: William Godfred Cantah

Abstract: As a key driver of economic growth, industrialization is crucial for developing countries since it promotes employment and can facilitate the attainment of Sustainable Development Goal One, which seeks to end poverty in all its forms. However, the slippery slope is that industrialization engenders climate change by emitting greenhouse gases, which contribute to extreme climatic conditions that also present challenges for developing countries. This necessitates a shift to sustainable industrialization methods through effective environmental policies.

Environmental Policy Effectiveness (EPE) indicators evaluate how close a country is to achieving a specified environmental policy objective. Although EPE is ideal for environmental protection, it can positively or negatively affect developing nations' industrialization agenda. This study investigates the non-linear effect of EPE on industrialization using data from 104 countries in Asia, Latin America & the Caribbean, and Sub-Saharan Africa spanning 19 years. It also examines the moderating effect of regulatory quality.

The study found a U-shaped effect of EPE on Industrialization. Thus, improving environmental protection scores initially deteriorates industrialization but tends to improve it beyond a certain threshold. However, the U-shape effect does not hold for sub-Saharan Africa. The study also establishes that regulatory quality is important in reducing the adverse consequences of EPE, especially in Asia. We recommend using tax holidays and financial incentives to promote environmental energy sustainability. Additionally, international cooperation is needed for knowledge-sharing and capacity-building to support industrial expansion while managing environmental concerns. Institutional reforms in Latin America & the Caribbean and sub-Saharan Africa should also prioritize environmental quality.

713. Foodways in Shani Mootoo's Fiction

Submission Type: Oral Presentation - 10:15 AM, Classroom A

Submission Category: Social Sciences and Humanities

Author(s): Medha Bhattacharyya

Faculty Mentor: Nathan Stormer, Haley Schneider

Abstract: The South Asians in North America are termed desi. Though desh means country, it is colloquially considered to be the entire South Asian diaspora community in North America and some other parts of the world consisting of nationals from not only India but also Pakistan, Bangladesh, Nepal, Bhutan, Maldives and Afghanistan. In this paper the desh (country) in question is India.

I will explore through rhetorical analysis how food helps in breaking/making of South Asian diaspora identity. The texts under analyses are: "A Garden of Her Own", "Out on Main Street" and "The Upside-Downness of the World" by Shani Mootoo, an Indo-Trinidadian-Canadian writer. In each of these stories, the quest of the protagonists to understand and come to terms with their Indian roots is evident. What food they enjoy, the rituals or festivals they talk about or are made to practice and what they put on determine their affinity to their country of origin. Also, their ability to exude their Indian culture brings about acceptability or rejection from the Indian diaspora community or even the White North Americans. This research is important as there is a dearth of research in this field.

This paper will ask pertinent questions like: Can desiness/identity be forced? Is desiness a monolithic term? In these three stories, I will portray through a close reading of the texts the impact of the situations, attitudes, struggles and adaptation techniques of migrants of Indian dissent in their 'adopted' country and how they come to terms with their desiness/identity.

714. Cognitive and Emotional Benefits of the Mindful Aging Memory (MAM) Skill Group: An Anonymous Focus Group Survey with Low Income Older Adults

Submission Type: Oral Presentation - 10:30 AM, Classroom A

Submission Category: Social Sciences and Humanities

Author(s): Morgan Tallman, Madison Landry, Holly Timblin

Faculty Mentor: Rebecca MacAulay

Abstract: Mindfulness-based interventions (MBI) have garnered interest for their potential to enhance mental and physical health and reduce the risk of cognitive decline and dementia in older adults. To our knowledge, no study has investigated how socioeconomically diverse older adults tolerate mindfulness practices. In the attempt to improve health and quality of life with aging, developing MBIs for diverse groups of older adults will be critical. Therefore, a 1-hour focus group was conducted to obtain feedback on mindfulness practices with diverse older adults at two low-income community-dwelling sites in Maine. Participants were introduced to different formal meditation practices (e.g., mindful breathing) and completed anonymous surveys to provide their feedback on the perceived benefits and challenges of this brief MBI. Results indicated that older adults universally enjoyed learning about mindfulness practices. The Top 3 Benefits qualitatively reported by participants were learning new tools, relaxing/reducing stress, and improved concentration. Participants also endorsed improved attention and thinking ($M = 4.33$, $SD = .89$), mood ($M = 4.30$, $SD = 1.05$), and feelings of relaxation ($M = 4.32$, $SD = .89$) on a 5-point Likert scale following the skill group. Notably, 48% of participants noted at least some difficulty in paying attention during the mindfulness practice. This study provides support for the acceptability of mindfulness practice and preliminary evidence of subjective cognitive and emotional benefits in a low-income older adult population. Given evidence of difficulty attending during brief mindfulness practices, future research is needed to develop MBIs designed for older adults.

715. Associations Among Memory Performance, Aging, and Symptoms of Anxiety and Depression

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Jie Ning Zhu

Faculty Mentor: Michael Robbins

Abstract: Memory performance is a critical aspect of cognitive function, as it refers to an individual's ability to encode, store, retain, and recall information. There are different measures to test memory performance, including the Wechsler Memory Scale. Various factors can influence memory performance, and individuals' memory performance will likely decrease as they age. This study will examine predictors of how individuals perform on different memory assessments, focusing on the Logical Memory and Visual Reproduction tests, both immediate recall and delayed recall. These predictors include age, education level, social activity level, and symptoms of anxiety and depression. It is hypothesized that as individuals grow older, memory performance will decrease. We also hypothesized that older individuals would perform more poorly on delayed recall compared to immediate recall. This study will use the Maine-Syracuse Longitudinal Study (MSLS) data archive, containing valuable information about aging individuals collected over seven longitudinal waves. Initial statistical analyses from wave 6 of the MSLS indicate: 1) strong positive correlations between scores for the logical memory and visual reproduction tests, both for immediate and for delayed recall; 2) a strong negative correlation between age, but a moderate positive correlation between education level, and memory performance; 3) some statistically significant but weak correlations for social activity level and symptoms of anxiety and depression with memory performance. Further analyses will examine additional predictors of memory performance for younger and older age cohorts.

716. What Bridges the Gap Between Forgiveness and Suicidality? Examining Emotion Regulation and Interpersonal Needs as Serial Mediators

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Caroline Kelberman, Eleanor Schuttenberg, Autumn Chadburn

Faculty Mentor: Jennifer Blossom

Abstract: Objective: Suicidality represents a significant concern for college students, thus more research is needed to understand the associated risk and resilience factors. Forgiveness represents a protective factor against suicide, and emerging literature has hypothesized interpersonal needs and emotion regulation (ER) as mechanisms in this relationship. The present study hypothesized that the relationship between forgiveness and suicidality is both independently and jointly mediated by ER and interpersonal needs, perceived burdensomeness (PB) and thwarted belongingness (TB).

Method: Undergraduate students (N = 514) from the University of Maine completed the Heartland Forgiveness Scale, Difficulties in ER Scale, Interpersonal Needs Questionnaire, and Columbia-Suicide Severity Rating Scale via Qualtrics.

Results: Two serial mediation models were analyzed using PROCESS Model 6. In the first model, ER and PB were examined as independent and joint mediators of the forgiveness and suicidality relationship, which accounted for 14.0% of the variance in suicidality ($p < .001$). More forgiveness predicted more ER, which then predicted less PB, and thereby less suicidality. In the second model, ER and TB were examined as independent and joint mediators of the forgiveness and suicidality relationship, which accounted for 10.2% of the variance of suicidality ($p < .001$). While more forgiveness predicted more ER, and thereby less suicidality, TB was not a significant predictor in this model.

Conclusion: While PB was an important factor in the relationship between forgiveness and suicidality, TB was not. The present study indicates that forgiveness-based interventions for suicidality should target PB to improve their effectiveness among college students.

717. Learning about Learning: Classroom Communication and Its Impacts on Students

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Hope Carroll

Faculty Mentor: Liliana Herakova

Abstract: Student retention and belonging continue to be a significant challenge in U.S. higher education, exacerbated by the COVID-19 pandemic (Office for Civil Rights, 2021). Particularly, first-year students experience emotional, relational and learning difficulties as they transition to college (Thompson, 2008). In response, scholars propose relationship-rich education as key to student success (Faulkner et al., 2021). Accordingly, this project explored the role of classroom communication in fostering students' learning and sense of belonging through both qualitative interviews with 11 first-year students and a learner's autoethnography. Two research questions were posed: 1) What are first year student perceptions on how communication in the classroom impacts their learning? and 2) What are the impacts of engaging in observations of classroom communication on undergraduate students' relationship to and understanding of learning? With regards to the first question, students named several communication practices as key to their academic success and sense of belonging. These included: connecting with both their peers and instructors, asking questions, and reflecting on their learning and the classroom environment. Addressing the second question, this research supports the value of students conducting classroom observations as a mechanism for becoming stronger advocates for their own learning, growing their metacognitive competencies, and developing an appreciation for the role of diverse relationships and communities in fostering meaningful learning. Results from this project have implications for cultivating relationship-rich educational training for both instructors and students.

Faulkner, S. L.,Watson, W. K., Pollino, M. A.m & Shetterly, J. R. (2021). "Treat me like a person, rather than another number:" University student perceptions of inclusive classroom practices. Communication Education, 70, 92-111. https://doi.org/10.1080/03634523.2020.1812680

Office of Civil Rights. (2021) Education in a pandemic: The disparate impacts of COVID-19 on America's students. Department of Education.

Thompson, B. (2008). How college freshmen communicate student academic support: A grounded theory study. Communication Education, 57, 123-144. doi: 10.1080/03634520701576147

718. An Exploration of Factors Impacting the Associations Among Cognitive Performance, Education Level, And Depressive Symptoms

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Sean Carey

Faculty Mentor: Michael Robbins

Abstract: This study is an extension of previous work presented at the 2023 UMaine Student Symposium, that observed the association of depressive symptoms and cognitive performance for cohorts of lower educated individuals and higher educated individuals. Using the Maine-Syracuse Longitudinal Study (MSLS) data archive, we found that: 1) individuals with higher levels of education showed higher cognitive performance as well as lower levels of depressive symptoms and 2) higher levels of education are somewhat protective of cognitive performance in relation to symptoms of depression. The current study aims to further investigate these associations by stratifying education level differently and by integrating additional variables in the MSLS into the analyses. To better understand differences among education cohorts, education level has now been stratified into three cohorts: Low, Medium, and High. Current analyses are integrating variables such as age, sex, use of psychotropic medication, marital status, social activity level, and number of cohabitants in order to characterize these education cohorts as well as to serve as covariates. In addition to a global index of cognitive performance, multivariate analysis of variance (MANOVA) as well as other statistical analyses are being used to investigate associations of specific cognitive performance domains with symptoms of depression for the education cohorts.

719. Translating Poetry Books: Libro De La Tentación Y Del Olvido and Materia Oscura

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Chelsea Johanson

Faculty Mentor: Carlos Villacorta

Abstract: This research project involves the investigation and translation of two poetry books written by Dr. Carlos Villacorta. These books are respectively titled: Libro De La Tentación Y Del Olvido and Materia Oscura. (Book of Temptation and Oblivion, and Dark Matter.) There are very few books in the United States that are translated from a foreign language into English, this is something that is known as “the 3% problem” in academic circles and it refers to the fact that only approximately 3 percent of foreign language books are translated into English in the United States. This concept was first introduced by Martin Boyd. Last semester I took the Spanish translation class SPA 444: Theory and Techniques of Translation where we had to review and translate many different styles of writing. When translating from one language to another it is necessary to recognize the importance of creating a reinterpretation of an original work while still simultaneously maintaining its authenticity. In preparation for this task, I read Theories of Translation An anthology of Essays from Dryden to Derrida and Languages: A Very Short Introduction by Stephen Anderson. I met with Dr. Carlos Villacorta throughout the process to update him on progress and review the ongoing research. The Spanish-English translation of these poetry books was undertaken with careful investigation and knowledge to create an accurate representation of both books in English. The final goal of this research is to publish these books for the general public to read.

720. Religious Self-Identity and Transphobia

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Sam Slavin, Alexandria Morgan, Sally B. Barker, Kalina Chazin-Knox,

Faculty Mentor: Jordan LaBouff

Abstract: In 2023 and 2024, there has been a rise in anti-transgender legislation, much of which has been fueled by Christian mores. Previous research has investigated whether religious or religious-national identities affect prejudice; however, little is known about the relationship between Christian nationalism and transphobia in America. To study this, we will prime participants on their Christian/American/Christian-American identities and then measure transphobia using the Genderism and Transphobia Scale. We hypothesize that priming religious or religious-national identity will increase transphobia, with Christian Nationalism moderating the effect of these two variables. Understanding the possible driving factors behind transphobia in the United States is important for resisting anti-transgender legislation and for informing vulnerable transgender communities.

721. Shoveling Sand: A Descent Into The Sinkhole— A Phenomenological Account of Grief Objects

Submission Type: Oral Presentation - 11:45 AM, Classroom A

Submission Category: Social Sciences and Humanities

Author(s): Kyra Pederson

Faculty Mentor: Kirsten Jacobson

Abstract: Think of an object that reminds you of someone in your life who has died, and how this object pulls you to them. I am interested in how we travel via memory in such an experience; in how much we are truly looking at them through this form of remembrance; and, whether they can be said to be looking back at us to any extent. In this project, I will investigate the character and role of this act of memoriam, and how much we are reliant on it as beings who necessarily live through and with the death of others. I will work on articulating a unique concept capturing this embodied mode of interpersonal recounting and recollection--namely, what I will call “the epitaphic look,” and I will do so using philosophical insights from Jean-Paul Sartre’s Being and Nothingness Laura E. Tanner's Lost Bodies: Inhabiting the Borders of Life and Death. I will apply this working understanding of the “epitaphic look” to explore the significance of “grief objects” as shaping pieces of our lives.

722. Sleep and Tauopathies: An Update of the Application of the PRISMA Method for a Systematic Review

Submission Type: Oral Presentation - 10:45 AM, Classroom B

Submission Category: Social Sciences and Humanities

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

Faculty Mentor: Fayeza S. Ahmed

Abstract: This project highlights a systematic review investigating the relation between tauopathies (a disease which reflects the pathological changes in the brain's tau protein). Tauopathies are often associated with aging disorders and causes of dementia, including Alzheimer's disease, frontotemporal dementia, and progressive supranuclear palsy (Williams, 2006; Leuzy et al., 2019). Sleep is a behavioral modifiable risk factor that has been implicated in many of these disorders, but the process, relationship, and mechanisms are still largely unknown. Understanding relationships between behaviors and disease pathology is crucial to furthering our understanding of causes of disorders, as there are no known cures for neurodegenerative tauopathies.

This review involved registering the project with Prospero, a database of potential systematic reviews and meta-analyses and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. This review included identifying a specific research question with inclusion and exclusion criteria for study comparison, including populations, disease, and techniques (such as imaging, sleep methodology, and biomarkers). Analysis is ongoing, but preliminary findings indicate that there is still a dire need to investigate the longitudinal relation between disease pathology and sleep.

The primary outcome of this project is to produce a paper to submit for publication in an academic neuropsychological or related-field (sleep, aging, dementia) journal. Further, this review can help differentiate sleep in pre-clinical tauopathies to promote and inform future research of risk factors and behavioral interventions. The oral presentation will describe the PRISMA method, which allows for reproducible literature searches via this standardized method, as well as the findings from this review.

723. Holy Alliances, Unholy Biases: Christian Nationalism's Role in Prejudice

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Alexandria Morgan, Sally Barker

Faculty Mentor: Jordan LaBouff

Abstract: A large body of evidence in the Psychology of Religion reveals a link between religiosity and prejudice in the United States. However, the relationship is more complex than it may appear. In an experiment studying white American Christians ("Religious Self-Idenity and Racism"), we found that Christian Nationalism was the driving predictor of racism and that Christians low in Christian Nationalism were more tolerant. Christian Nationalism (CN) is an identity created around the idea that the United States should be an explicitly Christian Nation. This ideology endorses a romanticized notion of the idyllic American past, which encourages prejudice towards groups that do not fit this ideal. In this presentation, I will explore the nuances between Christian Nationalism and other fundamentalist ideologies like Right-Wing Authoritarianism and Fundamentalism. Then, with our collected data, I will explore the differences in reported prejudice among White American Christians who do and do not endorse America as a Christian nation. Lastly, I will discuss the future directions I plan to take with prejudice research, where we will perform a replication of our previous study to investigate the relationship between CN and transphobia in the US.

724. Fast Friends

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Jenna Cox, Sally Barker

Faculty Mentor: Jordan LaBouff

Abstract: First year college students can struggle with a sense of belonging and mental wellbeing as they make the transition into college. Depression rates and loneliness among college students are higher than the general population and among the most common health problems faced by college students (Ibrahaim et al., 2013). An experimental procedure to generate intimacy created by Aron et al., (1997) could be used as an intervention in first year classrooms to promote friendships and improve mental wellbeing. This presentation describes the research on this intervention and our plan to test it with the incoming class of the Honors College. All students in one-half of the first-semester courses will be randomly assigned a partner and complete the intervention where they will ask and answer questions about themselves and their partner over about 45 minutes. Participants will also be asked to fill out pre and post experiment surveys regarding their mental well being. We hypothesize that students who complete the intervention will report more friendship, belonging, and greater mental wellbeing.

725. Sustaining Community and Identity through Food at the University of Maine

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Caty DuDevoir

Faculty Mentor: Daniel Sandweiss

Abstract: International students often travel thousands of miles to attend the University of Maine. Foodways become a way to sustain one's communal and self-identity. Food is more than nourishment: certain dishes also tell stories and become building blocks for conversation. Here, I focus on how international students use food as a vehicle to build community and understand the role of food to comfort and engage individuals. I also consider access to culturally significant ingredients, as the greater Orono/Bangor area lacks markets and stores that carry certain products. Through interviews, interviewees shared their foodways and experiences as international graduate students at the University of Maine. My findings show that international graduate students utilize food to maintain cultural identity, but barriers such as time, energy, and access to ingredients and transportation inhibit how often these students can engage in these cultural practices. These findings also bring cultural awareness and transmission of culture to the University of Maine campus.

726. Inclusive Representation in College Advertising: A Content Analysis of College Viewbooks

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Oliver May-Fleming

Faculty Mentor: Amelia Couture Bue

Abstract: Colleges use viewbooks as key promotional tools to project a desirable image to prospective students. The way these materials represent academic fields can subtly influence student perceptions and perpetuate stereotypes. This analysis examines the portrayal of STEM (Science, Technology, Engineering, and Math) fields versus non-STEM disciplines in college viewbooks, with a specific focus on how gender is represented. Through a content analysis, two coders analyzed photographs from 58 viewbooks, examining signifiers such as identifiable STEM identifiers, social environment, and gender presentation. We hypothesize that images of women with STEM identifiers will be less likely to exhibit traditionally feminine traits compared to women without STEM identifiers. Further, we predict that women with STEM identifiers will be less likely to be depicted socially than women in non-STEM environments. The findings could offer valuable insights into the persistence of gender disparities in STEM enrollment and the role of stereotypes in higher education. By understanding how colleges visually represent STEM, we can identify potential biases and work to create more inclusive and welcoming portrayals.

727. Engagement in Political Talk Among Student Members of Political Clubs on Campus

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Mariia Pugina

Faculty Mentor: Haley Schneider

Abstract: Nowadays politics are a taboo topic of discussion in many social contexts, and one of the reasons is incivility and even hostility associated with discussing politics. However, political conversations are thought to enrich democracy by improving the quality of public opinion and enhancing citizens' civic-mindedness (Bennet et al, 2000). This study focuses on engagement in "political talk" – "conversations about public concerns that take place in private, semi-public, and public settings… and have an informal and spontaneous character, in contrast to formally arranged and goal-oriented discussions and deliberation" (Nolas et al, 2017, p.3).

While the majority of research explores political talk outside of group identity, this study explores the phenomenology of political talk in student political clubs on campus – how and in what forms do students engage in political talk? Student political clubs are approached as norm-shaping social groups, where informal conversations with peers and political topics are intertwined. For the purpose of this study, a liberal and a conservative student political club were recruited. The study uses qualitative methods of observation and semi-structured interviews. Analysis is informed by the theory of normative social behaviors (Rimal & Real, 2005; Geber & Hefner, 2019) and the life-course model of political socialization (Wasburn & Adkins-Covert, 2017).

This study will contribute to exploring the research gap on everyday political talk among young adults (specifically, students on a university campus), the influence of structured social groups on engagement in political talk, and will also help understand better the social norms associated with political talk.

728. Connectivity Through Social Media

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Joseph Gerhart

Faculty Mentor: Mary PlymaleLarlee

Abstract: In this abstract, I will discuss the intricate communication norms that take place through social media platforms and this medium is used to establish meaningful connections. I will establish this understanding through an investigation of Stacey Pigg's Coordinating Constant Invention: Social Media's Role in Distributed Work, along with a dive into my own social media following and its use in maintaining connections with my friends across the country.

Social media is a tool that has only recently been established within the past two decades, but has a prominent ability to connect people across generations and across the world. Its relevance in modern society is very prominent, and has transformed how we communicate and interact with those around us. With this in mind, many can agree that the way you interact with friends and family over social media is quite different than say in person.

As mentioned previously, Stacey Pigg's work will be crucial in this investigation, as she clearly outlines the methods of connectivity through social media through her own investigation of an outline journalist named Dave. I can connect her work with my own and draw similar parallels between both of our works in order to build a common understanding of social media as an effective medium of communication. Speaking of my own work, I shall partake in an in depth investigation of my own social media, by detailing my list of followers and sorting them into specific categories applicable to how they relate to me (such as friends from the University, friends from back home, family members, etc.).

729. Examining the Longitudinal Effect of Social Network Size on Cognition During COVID-19

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Holly Timblin, Taylor Maynard, Morgan Tallman, Madison Landry

Faculty Mentor: Rebecca MacAulay

Abstract: Introduction: Social engagement is beneficial for physical and psychological well-being; however, the size of our social network decreases as we age. The rate of social isolation among older adults has worsened since the onset of the COVID-19 pandemic. Although social engagement is a recognized protective factor against cognitive impairment, limited information is available regarding the longitudinal effect of social network size on cognitive functioning. The present study investigated cognitive change as moderated by social network size at different levels.

Method: Seventy-seven participants (MAge = 70.82) completed neuropsychological testing before and after the onset of the pandemic and reported the size of their social network using a Hierarchical Mapping Technique prior to the pandemic. The COVID-19 impact survey asked participants to what degree they felt socially isolated due to the pandemic. MEMORE analyses were conducted to determine whether the size of social networks moderated cognitive change before and after the COVID-19 pandemic.

Results: Preliminary analyses revealed that social network size did not significantly moderate cognitive change on verbal memory or language measures.

Discussion: Despite previous studies finding beneficial cognitive outcomes for individuals with greater social network size, we did not observe the expected buffer effect of social network size on cognitive change due to limited access to social networks. Additional research is warranted to uncover protective factors that influence cognitive change and social networks.

730. Juveniles Who Sexually Offend: Does Victim Type Matter?

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Sophia Lambert

Faculty Mentor: Jeffrey Hecker

Abstract: Sexual violence is a major societal problem and public health concern. Recent research has demonstrated that the majority of sexual violence perpetrated against children is not by adults, but fellow juveniles. Youths who sexually offend make up a heterogeneous population, and a number of professionals in the field have suggested that identifying more homogeneous subgroups of these youths may lead to improved risk assessment and treatment strategies. The current systematic review investigates whether there are valid typologies of juveniles who sexually offend based on victim characteristics. Following the PRISMA guidelines, searches were conducted across four databases: PsycINFO, PsycArticles, PubMed, and Web of Science. Titles and abstracts were independently screened by two reviewers, and decisions were cross validated. Reviewing the literature on typologies of juveniles who sexually offend, we identified a corpus of articles addressing subgroups of youth based on victim characteristics. This systematic review summarizes this literature and aims to answer the following questions: Is there validity to categorizing juveniles who have sexually offended into subgroups based upon victim characteristics? What is the association between this typology and youths' trajectories? Has this typology been shown to be effective at matching a youths' risks and needs to interventions? Investigating these questions could aid in the development of more targeted interventions, and contribute to the prevention of sexual violence in adolescents.

731. Challenging Counterfeit Diversity: A Content Analysis of College Admissions Viewbooks' Representation of Women in STEM

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Erika Hipsky

Faculty Mentor: Amelia Couture Bue

Abstract: Women represent only 30% of scientists in the U.S., with just 34% of these women being people of color (EEOC, 2020). In response to these disparities, Science, Technology, Engineering, and Math (i.e., STEM) organizations and programs have made efforts to showcase women in their recruitment materials (Pippert et al., 2013). However, a trend of "counterfeit diversity" has emerged in these materials, including in college admissions viewbooks distributed by academic institutions (Osei-Kofi et al., 2013). Disingenuous representation of diversity has been found to threaten the retention of marginalized groups in STEM careers (Kroeper et al., 2020). To investigate this phenomenon, we conducted a content analysis of viewbooks from all New England colleges and universities with downloadable viewbooks available online (N = 57). Across viewbooks, two coders coded 2,867 photos and 5,120 individuals for qualities including gender, race, and presence of STEM-related objects. Forthcoming analyses will compare the gender and racial demographics of depicted students with actual enrollment data available via public datasets. The implications of these findings will be explored in depth.

732. Coastline in a Changing Maine: The Economics of Coastal Preference

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Walter Lange

Faculty Mentor: Caroline Noblet

Abstract: The State of Maine's coastal areas are experiencing substantial changes, from rising sea levels and diminishing fisheries to changing demographics and rising property prices. Coastal residents are evaluating tradeoffs between uses of coastal areas including aquaculture siting, recreational uses, traditional wild harvest or private property. A firm understanding of allocation preferences, including uses which support or detract from Maine's Blue Economy, allows decision makers to develop effective policies that are both spatially aware, and positive in outcome. To better understand the preferences of stakeholders, this project conducts a thorough empirical analysis of coastal survey data (2019) to determine preferences, views, and values in different regions along Maine's coast. The project includes information on preferences for how Maine's coast could be used (i.e. aquaculture, wild harvest, recreation), and opinions on how the coast is currently used.

733. School Closures and Dropout Rates in Rural and Urban Areas of Ethiopia: Household-level Evidence From the HFP-HS Survey

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Abraham Tamru Assefa

Faculty Mentor: Kathleen Bell

Abstract: Preventive measures adopted in response to the COVID-19 pandemic posed many challenges and resulted in some unintended consequences. One of those challenges was the disruption in students' learning outcomes due to schools' closures, a particularly acute issue in developing countries. In this study, I examine the relationship between schools' closures and dropout rates across rural and urban regions of Ethiopia by using the COVID-19 High Frequency Phone Survey of Households (HFP-HS) 2020 panel data. Methodologically, I estimated a fixed effects model with geographical time-invariant variable and year fixed effects. The results showed that the disruption in learning activities from school closures is significant, with only 32% of enrolled students engaged in remote learning nationally, while this number is much lower at 15% for students based in rural areas. Moreover, the range of instructional methods accessible to students in rural areas is notably restricted compared to their counterparts in urban settings. Finally, I show that remote learning is positively and significantly associated with enrollment for the new academic year in rural regions, while this relationship is not significant for students based in urban areas. Overall, the impact of school closures on students' learning was notably exacerbated in instances where there was inadequate technological infrastructure to facilitate remote education. As such, it is imperative for education policymakers, and other stakeholders to prioritize addressing the disparities in educational opportunities and allocate additional resources to ensure equitable access for all students.

734. Problem of Knowledge Multilangual Learners Face

Submission Type: Oral Presentation - 12:00 PM, Classroom A

Submission Category: Social Sciences and Humanities

Author(s): Lunive Noel

Faculty Mentor: Mary PlyMaleLarlee

Abstract: Multilingual people need to consider multiple factors when deciding what language(s) to use when interpreting, encoding, and responding to information. The variability in decision making presents the ability for problems of knowledge to be created. That is, as a result of being multilingual people have to know and comprehend so many different rules about syntax, grammar, spelling, punctuation etc., and they go through a series of investigations and negotiations to determine what rules or information about the languages they know and the social situation they are in is appropriate to respond “correctly” to what social situation they are in. Because whatever "correct" means in the various contexts they will face can change, they can experience "problems of knowledge" as they move between various languages. I will consult Paul Kai Matsuda's "Writing Involves the Negotiation of Language Difference" and “Bilingual Language Switching in the Laboratory versus in the Wild: The Spatiotemporal Dynamics of Adaptive Language Control” by Esti Blanco-Elorrieta and Liina Pylkkänen to examine and analyze what cognitive mechanisms language users employ when faced with problems of knowledge and what results from that. Additionally, I will draw on my personal observations of other multilingual language users, as they have had to decipher when to use the appropriate language in whatever context is needed. In the end my listeners will understand the problem of knowledge multilingual learners face when presented with various social contexts.

735. Are Rural States Equipped For The Youth Mental Health Crisis?: An Investigation of The Mental Health Attitudes and Stigma Beliefs of Caregivers

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Benjamin Roseman

Faculty Mentor: Jennifer Blossom

Abstract: There are clear mental health treatment disparities between rural and urban communities, especially in accessing quality mental health care and youth suicide prevention services. In 2021, the CDC reported an increase in youth mental health concern rates and alarmingly, a rise in youth suicidality rates. Considering these trends, and that rural people already experience higher suicide rates, the status of caregivers' readiness and ability to access mental health services for their children must be examined. The present study aims to investigate how caregiver stigma and knowledge about mental health and suicidality drives rural-urban disparities in suicide rates and access to quality mental health and suicide prevention services. A secondary aim of the study is to evaluate the association of past suicide risk and how it is affected by differences in mental health literacy, stigma, and service availability between rural and urban communities. To study these differences, a national sample of 300 caregivers will be surveyed about mental health literacy, stigma beliefs, service access, and awareness of youth suicide risk. Data collection is planned to be concluded in March 2024. It is hypothesized that rural caregivers' mental health literacy will be lower than that of urban caregivers, while rural stigma beliefs will be higher. It is also predicted that lower levels of mental health literacy and higher levels of stigma contribute to higher rates of suicidality and lower service access in rural regions. These findings will have major implications for how rural communities can work to enhance suicide prevention services.

736. Self-Efficacy is Associated with Self-Reported Health Status, but not to Physical Performance or Executive Functioning, in a Sample of Older Adults

Submission Type: Poster

Submission Category: Social Sciences and Humanities

Author(s): Caroline Mosca

Faculty Mentor: Rebecca MacAulay

Abstract: Objective: Self-efficacy is a term used to describe an individual's beliefs in their capability to achieve a certain outcome. Research has indicated that self-efficacy and the cognitive variable of executive function may both be independently linked to physical health status among older adults. However, research that explores relationships between all three variables in an older adult sample is limited. The present study tested the strength of these relationships in more depth.

Methods: Data was collected from older adult participants (n=114) as part of the Maine-Aging Behavior Learning Enrichment (M-ABLE study). Self-efficacy and health status were assessed using the PROMIS Global Health Scale; Physical performance was assessed on the Short Physical Performance Battery; EF was assessed via the National Institutes of Health Toolbox-Cognition Battery (NIHTB-CB).

Results: After controlling for age and education, partial correlation found significant findings between self-reported health and self-efficacy, $r = .195$, $p < .05$. There were not significant relationships found between self-efficacy and executive function, nor between self-efficacy and physical performance.

Discussion: In alignment with previous research, it appears that self-efficacy is linked to self-reported outcomes of health, but is not linked to physical performance outcomes or executive function. Implications are discussed.

801. Characterizing englacial deformation the Eclipse Icefield (Yukon Territory, Canada)

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Emma Erwin, Renée Clavette, Inga Kindstedt, Kailey Mannello, Jake Holmes

Faculty Mentor: Seth Campbell

Abstract: The Autonomous Phase Sensitive Radar (ApRES) uses a frequency modulated continuous wavelength to detect englacial stratigraphy with millimeter precision. By repeating measurements over an interval of time, vertical deformation of englacial layers can be captured. Here, we present findings from deploying the ApRES on the Eclipse Icefield (Yukon Territory, Canada). We collected 11 measurements across a ~1 km2 area of interest in May 2023. These measurements were repeated in June 2023 to evaluate change in depth of englacial features over an approximately month-long interval. Basal topography and englacial stratigraphy were also imaged using 5 MHz ground penetrating radar (GPR) to evaluate the efficacy of the ApRES in detecting the basal reflector across the icefield. GPR data is processed with ImpDAR, showing ice depths reaching 700 m and a clear, continuous isochrone aligning with the 1912 Katmai volcanic eruption. ApRES data is processed with both ImpDAR and Matlab, revealing englacial deformation at rates of several meters per year. In-situ surface velocity measurements collected in concert with the radar survey further support the high rates of ice deformation on the Eclipse Icefield. Our results show that at sites with surface velocities of this magnitude (5 - 70+ m/yr), ApRES measurements should be repeated over a shorter time interval to improve coherence between measurements, particularly at depth. Englacial strain rates captured in this study will be used to develop an improved depth-age scale of the glacial ice on the Eclipse Icefield, a potential future ice-coring site.

802. Surface Modification of Food Serving Containers using Lignocellulosic Materials under Gas Phase with Silanes as reactants

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mamoona Raheem, Viraji Senevirathne

Faculty Mentor: Mehdi Tajvidi, Carl P. Tripp

Abstract: Molded fiber is regaining popularity for food service applications attributed to growing concerns about plastic pollution and environmental sustainability. However, to make molded fiber products water and grease resistant, per- and polyfluoroalkyl substances (PFAs) are typically added to the system. In this study, various types of raw materials were mixed with cellulose nanofibers (CNFs) as a binder to develop an environmentally safe composite system for food serving containers. The particles used in the study included wood fiber (WF) and bleached kraft pulp (BKP). The optimized formulation (BKP 55%, WF 35%, CNF 10%) were surface coated by a thin layer of CNFs to impart grease resistance. The laminated samples then underwent surface modification under gas phase with reactants such as hexamethyldisilazane (HMDZ), methyltrimethoxysilane (MTMS), and trimethylmethoxysilane (TMMS) with pyridine as a catalyst, as silanes can form 2D polymers by reacting with adsorbed water on the surface. After surface treatment, these samples were characterized by IR spectroscopy, and their barrier properties were measured using kit and water resistance tests. Contact angle measurements and tensile testing were also performed on the samples. The water resistance, grease resistance, and mechanical properties of the samples improved with the treatment indicating that a gas-phase surface treatment can effectively enhance barrier and mechanical properties of molded fiber objects coated with CNFs.

803. Added Sugar Intake and Perceived Stress Negatively Predicts Body Image in College Students

Submission Type: Oral Presentation - 9:30 AM, Classroom A

Submission Category: Natural Sciences

Author(s): Kayla Parsons, Kelley Strout, Wenjun Zhou

Faculty Mentor: Jade McNamara

Abstract:

Objective

The objective was to determine if diet quality (DQ), added sugar intake (ASI) and perceived stress (PS) predicted (BA) among a sample of college students.

Methods

A cross-sectional study was conducted among first-year nursing students one week prior to the fall semester. Respondents completed an online questionnaire including Tylka's Body Appreciation Scale and Cohen's 10-item PS Scale. ASI and DQ were measured using the short Healthy Eating Index. A hierarchical multiple regression was used to identify if PS, DQ, and ASI predicted BA when controlling for gender.

Results

Participants (N=62) were mostly female (n=56, 90.3%), white (n=58, 93.5%) and on average 19.1±1.0 years old. Participants had an average BA score of 3.5 ± .8 out of 5, PS score of 17.5 ± 6.1 out of 40, and DQ of 50.9 ± 9.6, out of 100. Average ASI in teaspoon equivalents was 26.9 ±17.7. When controlling for gender, ASI (β=-.27, t=-2.28, p<.05) and PS (β=-.52, t=-4.68, p<.001) accounted for 36.5% of the variance in BA (F(3,56)=10.7, p<0.001, r2=.33), where total DQ was not found to be a significant predictor in the model.

Conclusions

ASI and PS predicted BA, suggesting further research is needed to understand how dietary choices and stress management interventions can work together to improve self-perception and move young adults closer to greater body appreciation.

804. Investigating the Relationship Between Sea Surface Temperatures and Karenia Brevis in the Gulf of Maine using Environmental DNA and Remote Sensing Technology

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Hannah Kauffman

Faculty Mentor: Erin Grey

Abstract: Karenia brevis is a problematic species of dinoflagellate with a distribution spanning from the Gulf of Mexico to New England. K. brevis, informally referred to as "red tide," is capable of multiplying rapidly and forming dense populations that release neurotoxins. While "red tides" caused by K. brevis are much more common in temperate waters off of the southeastern US coast, they are also detected as far north as the Gulf of Maine. Scientists have attempted to identify temporal, spatial, and biogeochemical factors involved in K. brevis blooms in order to more accurately predict when and where these blooms are likely to occur. In this paper, I perform a comparative analysis of average sea surface temperature (SST) and the detection of K. brevis in the Gulf of Maine using Landsat 9 thermal imagery and environmental DNA (eDNA) from 2021 to 2022. My results showed a difference of 15.8℃ in the ranges of SSTs and a difference of 3.7℃ in the mean SST between sites with K. brevis eDNA present than those without. My findings add to existing literature in the field by examining K. brevis' thermal tolerance range in the Gulf of Maine from 2021 to 2022. My study also demonstrates the ability to combine remote sensing and eDNA technology to investigate harmful algal bloom (HAB) species.

805. Using Song to Educate Children About the Ocean

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Alexandra Sousa

Faculty Mentor: William Ellis

Abstract: My capstone project is a collection of six original songs to educate children from kindergarten through third grade about whales and important ocean topics. The subjects included the history of whaling, the differences between baleen and toothed whales, humpback whale behaviors, oceanic pollution, invasive green crabs in Maine, and the basic ocean knowledge everyone grows up having. I wanted the lyrical language to be as simple as possible so that children could learn the words easily and sing along as well as understand the material. Subject matter for some of the songs originated from my summer whale watch internship and other inspirations, the importance of educating children on these subjects, and the effectiveness of music education.

The ultimate outcome is to reach a younger audience and provide them with a better ocean education. In my own experience, I did not learn about whales and specific ocean issues like pollution, whaling, or invasive species until I arrived at UMaine and became a marine biology major. Several studies throughout the past two decades have shown that introducing music as an educational tool in preschools and elementary schools has had a significant impact on children's learning abilities. It increases their creativity, listening skills, and critical thinking skills. I believe that it is very important to teach these topics when children are very young so that from an early age, we can make a difference in their lives and hopefully help them understand the need for protecting the marine environment and everything within it.

806. Testing Heat Tolerance in Coral Zooxanthellae Symbiont Symbiodinium trenchii

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Savanna Deer

Faculty Mentor: Erin Grey

Abstract: Corals are experiencing an unprecedented amount of stress due to human induced climate change. The increase in seawater temperature is particularly stressful, as it leads coral to expel their endosymbiont, a vital part of their physiology allowing them to create their own food; a mechanism called bleaching. Excessive and long-lasting heat waves cause coral to die, which leads to a cascading effect and collapse of a vital ecosystem. This experiment tests the thermal tolerance of the Indo-Pacific species of coral Stylophora pistillata and the ability of supposed heat tolerant zooxanthellae Durusdinium trenchii to repopulate this coral species after a bleaching event the. Four coral nubbins were thermally stressed to bleach by increasing water temperatures to 32°C to mimic heat waves. Post-bleaching, two of the nubbins were fed D. trenchi while the other two served as controls. Qualitative and quantitative analysis of bleaching and D. trenchi repopulation was used to assess the heat tolerance of the S. pistillata-D. trunchi symbiosis. This study helps us better understand coral and zooxanthellae heat tolerance under future climate change.

807. What Would it Take to Grow Glaciers on Mt. Washington?

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Jacob Pisani

Faculty Mentor: Alice Doughty

Abstract: Before the advance of the Laurentide ice sheet across New England, temperatures were colder and may have allowed for the formation of valley glaciers on Mt. Washington. However, exact climate conditions and ice coverage before the Laurentide covered Mt. Washington and the surrounding region are unknown. We use modern topography combined with past and present climate data with a 2-D model to simulate where we think past glaciers used to exist. The growth of these glaciers allows us to calculate the snow line and the temperature change from present day. We have determined some ideal temperatures to be 11ºC colder when 50% drier and 10ºC colder when 20% drier. The magnitude of atmospheric cooling provides us with insight to the effects of the changing climate of New Hampshire leading into the ice age.

808. Assessing the Influence of Interseeded Cover Crops on Beneficial Arthropod Abundance in a Northeastern Agroecosystem

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Charles Cooper

Faculty Mentor: Rachel Schattman

Abstract: Ground dwelling arthropods play an important role in agroecosystems, providing ecosystem services including seed predation and nutrient cycling. Because the relationship between cover crops and arthropod abundance may vary by management conditions, we investigated arthropod abundance in a field interseeded with cover crops on a Maine (U.S.A.) farm. Interseeding is an emerging practice in the northeastern United States, with potential to address the barriers to cover cropping following a late season cash crop harvest. Such barriers are primarily economic and ecological. It can be difficult to achieve sufficient biomass when cover crops are planned late in the growing season, diminishing potential ecosystem service benefits. In this study, arthropods were sampled using pitfall traps 3 times during the 2023 fall growing season. We sampled from plots that were either cover-cropped or not cover-cropped, with 4 replicates per treatment. Harpalus rufipes DeGeer (Coleoptera: Carabidae) was the most abundant species sampled, with Gryllus species (Orthoptera: Gryllidae) also highly abundant. H. rufipes and G. species are granivorous, providing seed predation services to regulate weed seedbanks. No significant difference in abundance or Simpson's dominance was found between treatments. Both cover crops and weeds provide habitat for beneficial arthropods. Suitable habitat is less available when intercrop space is left bare. Cover crops may provide the necessary habitat for beneficial species without the management complications and yield losses in systems with high weed pressure. The findings prompt further research on the myriad factors influencing beneficial arthropod abundance in agroecological systems.

809. Trends in Scientific Publications on the Ecology of Invasive Species Over Time

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Etain Cullen

Faculty Mentor: Andrei Alyokhin

Abstract: Invasion Ecology was first popularized in Charles Elton's 1958 monograph titled "The Ecology of Invasions by Animals and Plants," which defined biological invasions as a separate process from ecological succession. The purpose of this project was to investigate time trends in the interest in research surrounding biological invasions, specifically those existing within the field of ecology, since the initial spike in the number of publications on this subject beginning around 1975 until today. To accomplish this, multiple databases were constructed using the data contained in the Web of Science Core Collection, searching for all ecological papers published, ecological papers containing mention of invasive species and invasions, and ecological papers containing other terms commonly used interchangeably with invasive species (introduced, non-native, alien, and exotic). The increase in Invasion ecology papers and related terms was compared to the overall growth of ecological papers. The absolute number of publications dedicated to invasive species grew exponentially. When expressed as a proportion of the total ecological publications, however, the increase has become better described by a logistic curve. There was a significant overall dip in the number of publications related to the COVID-19 pandemic. Based on these trends, the study of invasive species appears to be a prominent, stable, and already mature subfield of ecological research.

810. Beyond the Shoreline: Investigating Gray Seal eDNA in Coastal Waters

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Jamie Fogg, Julia Sunnarborg, Christy Hudak, Lisa Sette

Faculty Mentor: Kristina Cammen

Abstract: Environmental DNA (eDNA), a non-invasive method of collecting DNA from water samples, is a powerful approach for assessing marine biodiversity and detecting a singular species. In this study, we build upon previous research of gray seal eDNA and explore the spatial dynamics of eDNA concentration in a coastal environment. Water samples were collected from a single haul out of 287 gray seals in Cape Cod, Massachusetts at varying distances from the shore and at two depths in the water column. The research objectives encompass three main areas. First, we aim to identify a spatial limit of detection, hypothesizing that beyond 150m offshore we will be unable to detect gray seal eDNA. Second, we assess the impact of environmental factors on eDNA dispersal along the shoreline, anticipating a downstream plume-like pattern. Lastly, we analyze vertical samples to evaluate eDNA dispersal through the water column, exploring the possibility of variations in concentrations at different depths. Our findings indicate that eDNA concentration decreases with distance from shore, is higher downstream of the haulout, and is detected more often in samples collected at the surface compared to at depth. This study contributes to the advancement of our understanding of eDNA dynamics and its potential applications for monitoring pinniped species in a coastal environment.

811. The Energetics of Diurnal and Nocturnal Tropical Small Mammals

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Abe Grunwald, Eric Brown

Faculty Mentor: Danielle Levesque

Abstract: Decades of study into the energetics of temperate endotherms has led to the belief that most endotherms operate at temperatures below their thermoneutral zone (a range of ambient temperatures where an endotherm does not need to produce energy to maintain their body temperature). However, mammal biodiversity is highest in the tropics where temperatures are consistently warm and the climate is relatively aseasonal. Therefore, unlike temperate species that must consistently generate heat to maintain elevated body temperatures, low latitude species spend more time at thermoneutrality or at temperatures where the costs of thermogenesis are low. To challenge the temperate paradigm, we tested the costs of living for both a diurnal (treeshrew) and nocturnal (tarsier) small mammal living in the equatorial tropical forests of Sarawak Malaysia using mechanistic niche-based modeling. We discuss how relatively higher average ambient temperatures and the lack of consistently low temperatures allow for a wider range of normothermic body temperatures. We argue that knowledge of these phenotypes are essential for predicting vulnerability to future climate change.

812. Immune Development and Immunocompetence of the Atlantic Sea Scallop (Placopecten magellanicus)

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Nichole Blackmer, Jennifer Perry, Brian Beal

Faculty Mentor: Timothy Bowden

Abstract: To meet the increasing demand of scallops in the U.S., Atlantic Sea scallop (Placopecten magellanicus) farming is on the rise. Farmers currently rely on wild spat to populate their farms, but the wild supply is inconsistent. Maine hatcheries are attempting to raise Atlantic Sea scallops and often experience large mortality events during the early life stages of scallops. There is currently a lack of knowledge concerning the sea scallop immune system, particularly during the larval stages. We aim to study immune markers to understand when the immune system develops. Scallop larvae were collected from the first four life stages representative of the scallop's planktonic lifestyle, including days 11 to 25, a window in the third life stage. We conducted quantitative PCR to analyze the expression of four immune markers: catalase, superoxide dismutase, ferritin, and heat-shock protein 70. The immune markers superoxide dismutase, catalase, and ferritin exhibited a decreasing trend in expression from day 11 to day 25. Heat-shock protein 70 showed little variation in expression between these days. These results indicate that scallops exhibit immune-related activity during the third life stage. Immune activity on day 11 suggests that these larval scallops may have encountered a pathogen on, or before, day 11 that required an immune response, which was then resolved by day 25. The developmental state of the immune system may inform the ability of larvae to resist pathogens. Hatcheries can use this information to develop improved management strategies to increase survival rates.

813. Immune Gene Expression and Thymus Development as Indicators of Immunocompetence in Lumpfish, Cyclopterus lumpus L.

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Gabriella Peluso, Ian Bricknell

Faculty Mentor: Timothy Bowden

Abstract: Sea lice are a major threat to the financial and biological success of farmed Atlantic salmon, and are one of the top contributors to economic losses in the industry. The use of lumpfish, Cyclopterus lumpus L., as biological control of sea lice in salmon net pens has increased recently in Europe and Atlantic Canada. To mitigate associated threats to fish welfare and biosecurity, aquaculture operations producing lumpfish must closely monitor the fishes' health and vaccinate them against harmful pathogens. An optimal vaccination regime has yet to be determined, as the understanding of lumpfish immune system development and adaptive immune response is still in its infancy. This project aims to identify and investigate the expression of genes directly related to the development of the lumpfish immune system and adaptive immune response, to establish when during development lumpfish become immunocompetent, and thus, may become responsive to early vaccination. Methodology will include qPCR analysis of the following genes spanning from 0 days post fertilization until 40 days post-hatch: recombination activating gene 1 (RAG-1), interleukin factor 6 (IL-6), tumor necrosis factor-alpha (TNF-alpha), immunoglobulin M (IgM), immunoglobulin T (IgT), lysozyme, and C-reactive protein. Agarose gel electrophoresis will be used to verify gene presence. Development of the lymphoid organ, the thymus, in embryonic and larval samples spanning from 0 days post-fertilization until 40 days post-hatch, will be monitored using histological preparation, hemotoxylin and eosin staining, and light microscopy. The intended outcome of this project is to inform lumpfish aquaculture operations of the developmental time point at which lumpfish are able to distinguish between "self" and "non-self" to ensure successful vaccination, avoid oral tolerance when fish are vaccinated, and minimize mortality caused by pathogens.

814. Potential Invasive Species in Maine through a Horizon Scan Lens

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Robert Rowe, Shehnaz Chowdhury, Emma Irvine, Nahida Kabir, Shayli Morris, Mariah Pearson

Faculty Mentor: Andrei Alyokhin

Abstract: Invasive Alien Species (IAS) pose a growing threat to biodiversity and ecosystem health, exacerbated by climate change and increased transport of goods. This study presents a horizon scan exercise aimed at identifying and prioritizing potential IAS for the state of Maine. Leveraging data compiled by undergraduate students in the Biological Invasions course at the University of Maine based on Internet research, a final list of 12 potential invasive species was created by graduate students. The species selection process considered factors such as frequency of mention, potential threat to native species, impact on humans, and previous invasions in areas similar to Maine. Species ranking was determined based on mention frequency, undergraduate and graduate self-ranking, and expert graduate student discussion. The list in order is emerald ash borer (Agrilus planipennis), spotted lanternfly (Lycorma deliculata), Asian longhorned beetle (Anoplophora glabripennis), beech leaf disease (Litylenchus crenatae mccannii), zebra mussel (Dreissena polymorpha), hemlock wooly adelgid (Adelges tsugae), potato wart (Synchytrium endobioticum), tree of heaven (Ailanthis altissima), Asian carp (Hypophthalmichthys nobilis), Asian clam (Corbicula fluminea), lone star tick (Amblyomma americanum), and giant hogweed (Heracleum mantegazzianum). By creating this list, this study aims to inform about potential invasive species that could harm Maine's native biodiversity and ecosystems.

815. Processing Waste Reduction in the North Atlantic Squid Fishery: Quality Assessment of Squid Wing Byproduct Over 6-month Frozen Storage

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mallory Perry

Faculty Mentor: Denise Skonberg

Abstract: The North Atlantic squid fishery includes two species of squid known as Doryteuthis pealeii (Longfin inshore squid) and Illex illecebrosus (Northern shortfin squid). During squid processing roughly 50% of the squid by weight is discarded as waste, including the wings. The purpose of this research is to reduce waste by developing food products from squid wings. The specific objective of this study is to assess the yield and quality attributes of raw squid wing product during 6-months of frozen storage. This will give us insight into the physicochemical and microbial quality of the raw squid wing to aid in the development of a frozen novel food product. The impact of squid species, processing methods (including chopping or grinding squid wings), and processing order (chopped or ground before or after freezing) were assessed. Compositional analysis including mineral, protein, fat, and moisture content were assessed during initial processing on ground and chopped squid wings. Analyses conducted each month for 6 months include protein related analysis (myofibrillar protein and peptides), water-holding capacity, drip loss, instrumental color, microbial quality (aerobic plate counts) and pH. These analyses are currently ongoing, and data will be statistically analyzed by ANOVA with $p < 0.05$. Our results will aid in the continuous effort to increase sustainability in the seafood industry by providing a comprehensive understanding of the optimal processing methods and utilization strategies for squid wing byproduct. By optimizing the utilization of this byproduct, the seafood industry can reduce waste, improve resource efficiency, and minimize its environmental footprint.

816. Dynamic Thinning and Velocity Fluctuations on Kaskawulsh Glacier

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Gavin Gleason

Faculty Mentor: Karl Kreutz

Abstract: Alaska and Northwestern Canada are witnessing some of the fastest glacier retreat rates globally. Starting in 1979, the Kaskawulsh Glacier in the St. Elias Mountains of Yukon has displayed significant terminus retreats. This research project aims to examine the velocity fluctuations of Kaskawulsh Glacier using NASA's ITS_LIVE data spanning

2012 - 2022 to test the idea that dynamic thinning may be a factor in terminus retreat. Glacier dynamic thinning is an acceleration of ice loss driven by changes in glacier flow dynamics. It amplifies glacier response to climate change, causing changes more rapidly than would be expected from atmospheric warming alone. In this project, I will examine multiple factors that could potentially contribute to glacier melt and velocity changes, including air temperature changes, precipitation rates, firn depth change, and proglacial lake drainage. To complement the satellite data, in-situ measurements of some of these contributing variables will be collected on the ERS410: Sea-to-Sky Experience research trip in May 2024. By comparing the in-situ data to the remotely-sensed velocity analysis, this study will highlight the primary controls on the mass changes of Kaskawulsh Glacier. Quantifying the relationships between glacier velocity and terminus retreat in the region helps us understand the exact causes of glacier retreat. Even if exact causation can not be identified, a velocity profile of the area can answer useful questions about how glacier dynamics have changed in the area. It is crucial to prepare for the downstream impacts of melting terrestrial glaciers to benefit local communities and the global community.

817. Developing a LAMP Assay to Identify Boghaunter Species in Southern Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Cynthia Bellavance

Faculty Mentor: Erin Grey

Abstract: This summer research project aimed to develop a Loop-mediated isothermal amplification (LAMP) assay for an Maine endangered dragonfly species (Williamsonia lintneri). LAMP technology allowed for eDNA processing to potentially run at a much faster pace in the field than current technology, in this case being PCR which must be done in a lab. Developing and improving the technology used for eDNA facilitated research on Ringed Boghaunter dragonfly populations in Maine may led the way for other species in future surveying and conservation of this species in Maine and other states. Over the summer, we made good progress on the development. We collected field samples from known W. lintneri habitat for in vitro testing and compared LAMP and more traditional qPCR assays in terms of cost, efficiency, and effectiveness. We also collected and sent out W. lintneri and non-endangered congener W. fletcheri samples for mitogenome sequencing to aid in LAMP and qPCR primer development. While sequencing results did come back, developing primers is still in progress for W. lintneri However, we were able to confirm that LAMP is a viable alternative to qPCR for detecting human fecal bacterium Bacteroides dorei, and we were also able to produce mitogenomes sequences for both Williamsonia species.

818. Developing a LAMP Assay to Identify Blue-Spotted Salamanders in Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Oluwadamilola Kolawole

Faculty Mentor: Erin Grey

Abstract: In this study, the Loop-mediated Isothermal Amplification (LAMP) assay and quantitative Polymerase Chain Reaction (qPCR) are compared for DNA detection in vernal pools. Initially targeting Ambystoma laterale, the project shifted to Bacteroides dorei. LAMP showed greater efficiency in detecting DNA up to 250 copies per µl, with a significant time advantage over qPCR. However, qPCR detected lower DNA amounts more effectively. This indicates LAMP's potential for rapid DNA detection, necessitating further research for a comprehensive understanding of its limitations and benefits. The study contributes to environmental DNA analysis, emphasizing the need for method optimization for specific applications and scenarios. Methodology involved DNA extraction from filtered vernal pool samples, followed by LAMP and qPCR assessments. The study's preliminary results suggest a promising direction for LAMP in rapid DNA detection. Future research should focus on optimizing LAMP for broader applications and understanding its comparative advantages over qPCR. This research provides significant insights into environmental DNA identification techniques and highlights the importance of adapting methodologies to suit different environmental conditions and sample types.

819. Application of Ground Penetrating RADAR to Analyze Permafrost Structure

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kavya Dayananth

Faculty Mentor: Karl Kreutz

Abstract: Permafrost is a vital carbon sink, as it holds organic material that cannot decompose due to being frozen within the ground. With Arctic regions being one of the quickest changing due to symptoms of climate change, a deeper understanding of permafrost and its capacity to hold greenhouse gases despite warming temperatures is necessary. By using a combination of already existing data and field methods, a study will be conducted to compare the permafrost structure in two locations with varying factors. For this study, the first location will be permafrost land that has a healthy forest, while the second location will be permafrost land that has been clear cut and lacks large, healthy vegetation. This data will be collected during the Sea to Sky Experience this May, where our team will be traveling to Juneau, Alaska to take part in this field camp.

By Using Ground Penetrating RADAR (GPR) in the field, a subsurface profile of these two locations will be created. These profiles will then be processed and analyzed to show differences in the permafrost structure. Predictions for results of this study would fall into line with the current understanding of the relationship between permafrost stability, land cover, and rising temperatures. I predict that regions with forested permafrost will be thawing at a slower rate than the permafrost land that has been clear cut. Forests provide shade from the sun, so more exposure to the sun will result in more thawing of the permafrost. Although I have predictions about what the general trend of my collected data will look like, it’s important to find quantitative values within this study. These numbers can give insight into how irresponsible land management can lead to further carbon release from permafrost land.

820. A Comparison of Phytoplankton Abundance and Diversity in the Damariscotta River Estuary

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Maria Pagliaro

Faculty Mentor: David Townsend

Abstract: The goal of this study is to determine phytoplankton species presence and abundance, as well as why species assemblage changes may be occurring and how the changing water quality (i.e. temperature, nutrients, salinity, dissolved oxygen) is affecting them. Phytoplankton are the foundation of estuarine food webs. The Gulf of Maine (GOM) is warming at an increased rate as a result of climate change shifting the Gulf Stream North Wall and influencing the water masses entering the GOM. The rapid warming affects phytoplankton abundance and diversity as they adapt to the increasing change. Using field and lab methods, phytoplankton assemblages were sampled during the summer and fall 2023 at two sites, an estuarine and offshore site in the GOM. Surface samples were collected at the Darling Marine Center (DMC) Dock with a Van Dorn Bottle and at two depths, surface and 10 meters, from the offshore site during cruises on the Damariscotta River Estuary. Each sample was preserved with formalin for later analysis by microscopy. The sample taken at 10 meters targeted the chlorophyll maximum within the stratified water column of the estuary. The samples were analyzed to a genus level. There was a variety of common species that are found in the Gulf of Maine, however, the most common phytoplankton seen in all samples were Chaetorceras sp., Asterionellopsis sp., and Thalassiosira sp. The offshore site, station MEC, had approximately double the abundance of phytoplankton compared to the DMC dock samples. Station MEC featured Tripos muelleri, the dinoflagellate that was blooming in the Western Gulf of Maine this summer which created low dissolved oxygen levels. The species has been found in the Gulf of Maine for years, but was observed in a quantity almost 100 times the normal level. Possible triggers for this large bloom are warming sea temperatures, a mild winter, and increased heavy summer rains. With a consistent increase in water temperatures and more mild winters occurring, there is a high probability of large blooms increasing in frequency which may create aquatic conditions negatively impacting fish, lobster and shellfish populations, which support key industries along Maine's coast.

821. Measurement of Freshwater Flux from Mendenhall Glacier

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Thomas Young

Faculty Mentor: Karl Kreutz

Abstract: Glacial landscapes are some of the most susceptible environments to climate change and understanding how they will respond to planetary warming is a key focus of modern climate science. One such predicted response to warming is an increase in freshwater runoff from glaciers, leading to reshaped downstream flow patterns. This is highly relevant to the Gulf of Alaska's oceanographic processes, as salinity has a more significant effect than temperature on water density gradients in the area. Changes in these gradients could lead to different flow regimes emerging, and thus enough freshwater inputs could possibly lead to changes in the strength of the Alaska Current or Alaska Coastal Current.

To investigate the effects of freshwater inputs into the Gulf of Alaska, I will attempt to quantify freshwater flux coming from Mendhall and/or Lemoncreek Glaciers. A pressure transducer will be used to measure the different between atmospheric pressure and the pressure at the bottom of a runoff stream, which can be used to calculate the depth of the water column. Combining this data with in situ measurements of the stream's dimensions, I hope to be able to quantify the total freshwater flux. I also hope to utilize data from other nearby flow gauges and potentially extrapolate the amount of freshwater coming into the Gulf from other glacial sources. Ideally this will be done in a way that supplies us with a more holistic understanding of the effects of freshwater on local oceanographic processes.

822. Investigating Environmental Change at Andy Lake

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Shannon Thompson

Faculty Mentor: Karl Kreutz

Abstract: In the vast expanse of the Arctic Circle in northern Alaska, Andy Lake merges as an extraordinary geological anomaly, boasting an age surpassing 150,000 years as it stands ten times older than its regional counterparts. This positions Andy Lake as a central focal point for providing more insight into environmental transformations spanning millennia. This study, rooted in paleoecology, seeks to unravel the intricate tapestry of past ecosystems and environments, offering a unique lens into landscapes and ecological processes that have shaped the world for hundreds of thousands to millions of years. Lake sediment cores, a primary investigative tool, are used to collect a stratigraphic record of environmental fluctuations. These cores, obtained by hand-powered devices on lake platforms or icy surfaces, serve as time capsules, unveiling shifts in climate, vegetation, and fire patterns through pollen, charcoal, and chemical analyses. In this study, these cores collected basal sediment from Andy Lake to offer a glimpse into the area's ecological history. Recent advancements extend the analysis to animal communities, utilizing spores from fungi and ancient DNA within the area of Andy Lake. This core will help to justify the past and future to support Andy Lake as potentially the oldest in the region. This unique data will become a pivotal resource to the ancient records of climate, vegetation, and animal community changes in northern Alaska.

823. Yellowtail Kingfish Larval Immune Development

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Lingzi Ding

Faculty Mentor: Timothy Bowden

Abstract: Yellowtail kingfish (Seriola lalandi) is an ideal aquaculture candidate species currently being developed for commercial production, and production facilities are being developed in Maine. However, the aquaculture of yellowtail kingfish faces difficulty dealing with the high mortality problem during larval rearing in hatcheries. The bottleneck may, in part, be due to the undeveloped immune system of larvae. Therefore, we want to investigate the species-specific larval immune development to optimize the hatchery management strategy and improve the larval survival rate. This project aims to investigate the larval immune development of yellowtail kingfish by measuring immune gene expression and building an immunological development timeline. Larvae samples at early developmental time points were collected to investigate immune gene expression and create a timeline for the functional immunity of fish larvae. qPCR was utilized to test yellowtail kingfish larval samples for expression of immune genes, including RAG-1, IgM, C3, lysozyme, and C-reactive protein (CRP). Adaptive immune genes RAG-1 and IgM were detected at 0 dph. RAG-1 mRNA expression had an increasing trend after 6 dph, which may indicate the beginning of the maturation of the lymphoid organs. However, IgM mRNA didn't have a significant increase at the investigated developmental stages. C3 mRNA was found at the hatching stage, which might be related to the beginning of the setup of the immune system. C-lysozyme mRNA didn't have an initial increase in the larval stage. The 'peak' expression of CRP at 6 dph indicates larvae got inflammation or were under stress around this point.

824. Evaluating the Effects of Parasite Infections on Reproductive Potential in Maine Moose

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Isabella Costa, Alaina Woods, Pauline Kamath

Faculty Mentor: Pauline Kamath

Abstract: Despite conservation efforts, moose have experienced increasing mortality rates. Winter ticks are known to cause anemia and lower reproductive potential in moose. Moreover, *Anaplasma spp*., a genus of bacteria is known to cause a reduction in reproductive efforts in cattle. Because both winter ticks and *Anaplasma spp*. may affect female reproductive ability, the goal of this project was to determine if *Anaplasma* bacterial infections could be impacting moose cow reproduction within the state of Maine. To address this, samples and biological data from moose were collected during hunter harvest, in collaboration with hunters and the MDIFW (Maine Department of Inland Fisheries and Wildlife), and molecular analyses were performed to determine *Anaplasma* infection status. Using these data, statistical models were used to examine relationships between parasite infections, potential individual risk factors including age, weight, and location, as well as corpus luteum counts. Out of the female moose (cows) included in the hunter harvest program, less than half (13 out of 36; 36%) of the moose tested positive for *Anaplasma* with the use of a PCR-based assay. Moreover, 19% (7 out of 36) of the cows had undetected corpora lutea. Additionally, more than three quarters of the cows (29 out of 36; 81%) had at least one corpora lutea. However, of these, 61% (22 out of 36) of the cows had one corpora lutea whereas 19% (7 out of 36) had 2 corpora lutea. The results of this project on how *Anaplasma* infections affect moose reproduction may help inform management and harvest recommendations

825. Gelatin-glutaraldehyde-cellulose Nanofiber Based Biodegradable Packaging Films with Improved Barrier and Mechanical Properties

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Zhijing Zhan, Jinwu Wang, Ling Li, Mehdi Tajvidi, Denise Skonberg

Faculty Mentor: Qing Jin

Abstract: Developing food packaging using bio-based and biodegradable materials to replace fossil-based plastics, while maintaining favorable barrier and mechanical properties, remains a great challenge. In this study, we formulated a biodegradable packaging film using gelatin, glutaraldehyde, and cellulose nanofibers. The water vapor permeability (WVP), oil permeability (OP), oxygen transmission rate (OTR), mechanical property, and microstructure of the films were evaluated. Our results showed that the incorporation of nanocellulose into the gelatin matrix enhanced the film's water, oxygen and oil barrier properties, as well as its mechanical strength. As the cellulose nanofiber content increased from 0.1% to 1%, WVP followed a quadratic-linear distribution, with the optimal water barrier property achieved at 0.3%. As the content of nanocellulose increases from 2% to 5%, the oxygen transmission rate decreases by 38.36%. The tensile strength also increased with higher cellulose nanofiber content, attributed to strengthened hydrogen bond interactions. Furthermore, the addition of glutaraldehyde resulted in a 33.21% average reduction in film thickness, 40.93% reduction in oxygen transmission rate and a maximum 49.86% improvement in water barrier property compared to films without glutaraldehyde. This enhancement could be due to increased chemical cross-linking between gelatin and nanocellulose facilitated by glutaraldehyde. Interestingly, glutaraldehyde addition did not remarkably affect the films' oil barrier properties (OP kit tests all pasted 12/12). Our study indicates that gelatin-glutaraldehyde-cellulose nanofiber based biodegradable film, with good barrier and mechanical properties, are potent to be used as an effective and environmentally friendly food packaging.

826. The Use of Probiotics to Improve Survival in Atlantic Sea Scallop (Placopecten magellanicus) Larvae When Challenged with Pathogenic Vibrio Species

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Kyle Brennan

Faculty Mentor: Timothy Bowden

Abstract: The Atlantic sea scallop supports one of the most economically important fisheries in the northeastern US. As demand for sea scallop meat increases, wild harvest efforts must be supplemented with aquaculture. Scallop farmers rely on spat acquisition to continue production, yet wild spat collection is inconsistent. Hatcheries in the state of Maine could produce spat year-round but struggle with mortality events, presumably from pathogenic bacteria. Probiotics have decreased mortality amongst Vibrio infected bivalve larvae in other fisheries and could be implemented to decrease larval sea scallop mortality. Eight probiotics and two pathogenic bacteria have been identified from similar industries and cultured. Bacterial competition assays were used to examine inhibition of selected pathogens by probiotic candidates. To test the effectiveness of applied probiotics, challenge trials with larval sea scallops were conducted in vitro. The impacts of promising probiotic treatments on the growth and development of larval sea scallops will be monitored in larger-scale in vivo trials. Inhibition of pathogenic bacteria by probiotic candidates has been displayed, and two candidates increased sea scallop larvae survival during in vitro experimentation. Larger hatchery-size challenges are underway in vivo and display interesting preliminary results. This study will examine probiotic-pathogen interactions in Atlantic sea scallop hatcheries and may identify probiotic pretreatments to decrease larval sea scallop mortality in Maine hatcheries.

827. The Effects of Shear Stress on Sediment in an Erosion Chamber

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Grace Bauling

Faculty Mentor: Emanuel Boss

Abstract: Water quality is tightly linked to suspended sediments within it as those are a vector for pollutants as well as affect the light field available for oxygenating photosynthetic organisms. Human activity and climate change as changed river and coastal increasing the need for sediment erosion control. Critical shear stress testing of marine sediment, which determines what kind of flows will result in sediment resuspension, is currently expensive and not readily available for everyone in need of it. In this project I am going to create an erosion chamber that uses water flow and sediment suspension to calculate the critical shear stress of specific sediment samples. The design of the erosion chamber is based on the Gust Erosion Chamber. It requires an acrylic cylinder that contains an attached current breaker, an insert for 2-inch sediment sample, and the ability to hold water. The flow in the device is created by using a specific propeller driven by a motor and the measurement of the flow as well as associated turbidities are recorded to determine the value of flow that triggers resuspension. Calibration of the erosion chamber is needed to generate accurate shear stress data from sediment samples. The erosion chamber allows for a cheaper and accessible way to calculate erosion parameters of a sediment sample and creating a frugal design can teach others how to do it effectively.

828. Establishing an Atlantic Salmon (Salmo salar L.) Primary Gill Cell Line for Advancing Research on Infectious Salmon Anemia Virus (ISAV) HPR0

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Daniel DeLap, Sarah M Turner

Faculty Mentor: Deborah Bouchard

Abstract: Infectious Salmon Anemia Virus (ISAV), belonging to the Orthomyxoviridae family, consists of eight negative single-stranded RNA segments and is the causative agent of infectious salmon anemia (ISA), a serious disease of Atlantic salmon (Salmo salar L.). ISA can cause significant mortalities of up to 90% in infected aquacultured Atlantic salmon . ISAV can be classified into two subtype groups, a highly virulent HPR-delete variant and avirulent non-delete variant (ISAV-HPR0). Whether or not avirulent HPR0 leads to virulent HPR-delete remains in question. Understanding the dynamics between these two variants could play a vital role in helping to control disease outbreaks caused by ISAV-delete and thus lead to a more economically sustainable Atlantic salmon aquaculture industry. One major hurdle to better understanding the role that ISAV-HPR0 plays in virulence and disease is due to the inability to propagate and amplify ISAV-HPR0 in cell lines. Because ISAV-HPR0 appears to mainly target Atlantic salmon epithelial gill cells, a method for culturing primary gill cells from Atlantic salmon was developed. In repeated trials, 100% confluency was obtained in 25cm2 cell culture flasks but subculture of these cells was not achieved. Establishing Atlantic primary gill cell lines could lead to amplification of ISAV-HPR0 for further investigation of the relationship between virulent HPR-delete and avirulent HPR0. With the ability to culture primary gill cells, continued research aims at preparing primary gill cells from Atlantic salmon that have tested positive for ISAV HPR0 to determine if amplification of the viral agent can be achieved in these cells.

829. The Effects of the 2023 Wildfires on Moose Habitat in Quebec

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Tristan McMerty

Faculty Mentor: Sabrina Morano

Abstract: Moose(Alces alces) are a cryptic and charismatic animal that play a large role in the economy as well as in the culture of many Northern regions across the world. Moose have been shown to be affected by several types of disturbances, such as timber harvesting, forestry management practices, and wildfires. Moreover, we are seeing wildfires are increasing in intensity and frequency, leading to questions regarding the impacts of larger, more intense fires on moose populations. Moose require interspersion of habitat characteristics, so a homogenous burn area could be problematic for this reason. I investigated the 2023 fires from Quebec to determine what fires were large enough to have a potential negative impact on moose. To do so I assessed what specific characteristics of those fires were the major determinants of the quality of that habitat for moose. To determine which of the burned areas will be utilized I assessed proximity to other seasonal habitat components used by Moose. A literature analysis was conducted to determine the parameters that would be used for suitable habitat including variables like average distance from edge, characteristics of seasonal ranges, and average dispersal distances. Remotely sensed data from Quebec Data Partnership as well as the Canadian National Wildfire Database were used to assess the burned area as well as the habitat characteristics nearby. Overlay analysis was conducted to determine which fires have the potential to impact moose habitat. Determining how an increasing fire regime affects moose populations will be critical to know for management as the climate continues to warm.

830. Evaluating Benthic Exchange of Methane and its Role in Greenhouse Gas Export From Intertidal Wetland

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Rachael Smith

Faculty Mentor: Jiaze Wang

Abstract: The global amount of greenhouse gasses (GHGs) such as carbon dioxide (CO2) and methane (CH4) have dramatically increased since the industrial revolution. This has called for process-controlling research to understand greenhouse gas cycling and fluxes across natural ecosystems. As important interfaces connecting land and ocean ecosystems, coastal wetlands such as salt marshes have been recognized as critical carbon sinks that sequester carbon in the sediment at a rate estimated to be ten times higher than that of a forested environment per area basis, but their contributions to the surface carbon fluxes (i.e., outgassing, lateral carbon export) as carbon sources are poorly constrained. In part it is because of the lack of process-controlled understanding of benthic exchange in the intertidal zones of coastal wetland systems. To better understand carbon fluxes escaping from the subsurface in coastal wetlands, we developed a subsurface reactive transport model that includes surface tidal hydrodynamics and key biogeochemical reactions (i.e., sulfate reduction, nitrification, methanogenesis, and methanotrophy) in the subsurface. Focusing on benthic exchange of dissolved inorganic carbon in intertidal zones, we will conduct model simulations for idealized micro, meso and macro tidal environments, and evaluate the significance of benthic exchange-driven inorganic carbon export from different tidal environments.

831. Alaskan Permafrost Structure and Emissions in Disturbed and Undisturbed Locations

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Angelina Bucco

Faculty Mentor: Karl Kreutz, Seth Campbell

Abstract: Subarctic and arctic permafrost has been subject to unprecedented melting as the global climate warms due to anthropogenic influences. Permafrost underlies approximately 11% of the global land surface1 in the most conservative estimate, 15% in the Northern Hemisphere1, and about 80% in Alaska2. This consistently frozen ground has the potential to release large, relatively unknown amounts of greenhouse gases (CH4, CO2) as previously frozen organic matter begins to decay. Alaska stands to be greatly affected by permafrost thaw due to the significant percentage of land underlain by perennially frozen ground. This study aims to assess how active layer structure and methane off-gassing differ for permafrost that underlies an anthropogenically disturbed area compared to a natural area. Two sites will be identified: one disturbed, and one natural. Each site will be assessed geophysically with ground penetrating radar (GPR) and GEM-2 to determine active layer depth and structure. This will be groundtruthed with a manual frost probe. A Picarro GasScouter G4301 will transects on each site to measure georeferenced point methane emissions in situ. This data will then be used to obtain an estimated methane flux from each site. This study will provide a preliminary assessment of how human activity impacts permafrost structure and thawing, as well as methane emission potential. Permafrost remains a critical component in calculating global methane emissions. Understanding how human development has impacted its structure and emissions is crucial to refining emissions and climate change estimates.

832. Predation On Threatened Species: Diagnostic Bones To Inform Species Interactions

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Keiara Pham, Jeremy D. Romer, Kevin A. Stertz

Faculty Mentor: Christina Murphy

Abstract: Bones and similar structures can provide information on the species and estimated sizes of decomposed or digested fishes. This information can be used to expand information on ingested prey, archeological remains, or damaged specimens. However, relating these diagnostic structures to attributes like size requires knowledge of the target relationships from whole fish. Here, four cranial bones (cleithra, dentaries, and opercles) and otoliths, collectively 'diagnostic bones', were extracted, cleaned, and measured from whole juvenile Chinook Salmon, *Oncorhynchus tshawytscha.* We used linear regressions to establish fork length relationships for multiple measurement axes of these diagnostic bones for three distinct groups: hatchery, naturally produced, and surrogate juveniles. These groups were all sourced from the Willamette Basin, Oregon, but represent unique growth trajectories. Our findings of strong correlations (>80%) between all measured bones and fish lengths support the use of bones as a diagnostic tool in estimating lengths. However, despite this strong support for the use of diagnostic bones generally, regressions were unique to each group. Our observations highlight the need for population and life history specific allometric data when constructing regression models to ensure they are representative of the target population.

833. Development of a Field-Deployable Infrared-Based Method for Detection of BTEX Compounds in Water

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Graham McLaughlin, Rihab Masmoudi

Faculty Mentor: Carl Tripp

Abstract: This project addresses the difficulties in monitoring the content of Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) in water. BTEX are volatile organic compounds (VOCs) of significant environmental concern, with stringent regulatory limits set by the US Environmental Protection Agency. The limits for BTEX in drinking water are 0.005 ppm, 1 ppm, 0.7 ppm and 10 ppm, respectively.1 Current methods for BTEX analysis in water typically rely on expensive, labor-intensive lab-based techniques like GC-MS, which is unsuitable for field deployment. Our research aims to introduce a novel, field-deployable approach for the detection and speciation of BTEX compounds by utilizing an infrared transparent membrane in conjunction with a handheld Infrared (IR) spectrometer. By employing an IR-transparent membrane, our method greatly simplifies the sample preparation procedures. The sample can remain in the solid phase, greatly simplifying the analysis process. Our primary challenge lies in prolonging the amount of time that the volatiles can remain on the membrane prior to their evaporation. To address this challenge, we use membranes that do not need to be dried prior to analysis. We then cool the membrane to -80°C in a home-built dry ice cryo-sample holder to trap the BTEX within a layer of ice, thereby extending the duration of sample retention for up to an hour. Preliminary findings demonstrate the effectiveness of this technique in prolonging the sample's presence on the membrane. This innovative approach holds promise for revolutionizing BTEX monitoring, offering a practical, cost-efficient, and portable solution suitable for both industrial and environmental applications.

(1) US EPA, O. National Primary Drinking Water Regulations. https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations (accessed 2023-10-11).

834. The Impacts of Glacial Melt on the Herbert River and Eagle River

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Jenna Burke

Faculty Mentor: Karl Kreutz

Abstract: The increasing rate of glacial melt due to climate change releases a time capsule of elements and particles into nearby freshwater systems altering the modern chemistry of the water. This change raises concern to the potential of bioaccumulation within biological organisms. To determine the impact of glacial melt on freshwater chemistry I will be collecting water samples from the Herbert River in Juneau, Alaska and Eagle River in Anchorage, Alaska. The University of Maine has multiple water samples from both rivers from 2023 which can be used to compare results. NMR Spectroscopy can be used to analyze the water samples to determine what molecular compounds are present.

Eagle River has a small salmon population with fishing regulations but if locals are catching and consuming salmon that are potentially bioaccumulating contaminates their health may be at stake. The NMR spectroscopy results will indicate all molecular compounds present in the sample which will be compared to the previous years results. Published glacial research will be of use in order to determine the origin of the various compounds. Comparing and monitoring the chemistry of these water samples will give insight to how the water cycle and biological organisms are impacted by climate change.

835. The Movement of Nematocysts in the Sea Slug Berghia Stephanieae

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Emily Hartmann

Faculty Mentor: Ian Bricknell

Abstract: This project investigates the fate of nematocysts, or stinging cells from a pest anemone, Aiptasia pallida, eaten by a predatory sea slug, Berghia stephanieae. These sea slugs, or nudibranchs, steal these cells from the anemone's tissues and are transported from the nudibranch's digestive tract to the cerata, small defensive structures on the sea slug's back. This study uses histology and electron microscopy to examine how the nematocysts get transported in Berghia's tissues. Experimental slugs were starved for six days, allowing any residual nematocysts previously uptaken to be ejected from the tissues. They were then fed, collected, and processed for histology and electron microscopy (EM) for 0,1,4, 6, 7, 8 and 24 hours. Five-micron paraffin sections were cut for light microscopy and stained with Masson's TriChrome Stain or ultra-thin sections after the cerata were embedded in Spurr's C epoxy resin and stained with uranyl oxide and lead nitrate for EM. Early results suggest that the cells are transported through the digestive tract using chaperone cells, and subsequently the animal's hemolymph to their final position in the defensive cerata. Although the study is still ongoing, the Berghia can replace the nematocysts in their cerata within 24 hours of feeding.

836. Utilizing Retired Lobster Traps as Artificial Reefs: Mitigating Ghost Fishing Impacts and Enhancing Marine Conservation

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Deanna Gladstone

Faculty Mentor: William Ellis

Abstract: The lobster fishery is a vital component of the nation's economy, boasting an annual income of over $1.5 billion. Despite its historical roots dating back to the 1600s, the industry experienced significant growth only in the mid 19th century. However, the loss of lobster traps, is estimated at 5-15% annually which is equivalent to around 175,000 traps lost each year. This loss poses a grave threat to ocean ecosystems. Lost traps can continue to ghost-fish, leading to the depletion of invertebrate population and contributing to marine pollution. This study aims to assess the environmental impact of ghost traps, identify optimal extraction methods, and explore avenues for repurposing retrieved traps. Through a combination of literature review and empirical research, an understanding of the implications in which ghost traps oppose as well as develop strategies for their safe removal and investigate the transformation of retrieved traps into artificial reef structures using Autodesk technology. By addressing these objectives, the goal of this experiment is to facilitate habitat restoration, mitigate environmental entanglement risks, and alleviate marine pollution, thereby fostering positive impacts on coastal ecosystems and the fishing industry.

837. Transformation of Diploid Potatoes Using the Marker RUBY

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Strix Kugler

Faculty Mentor: Han Tan

Abstract: Breeding potatoes through traditional means is time consuming and requires the screening of thousands of genotypes to find ones that are viable for broad usage. Genetic engineering can be used to accelerate the rate at which new varieties of potatoes can be developed, through the direct addition/alteration of genes. Diploid potato lines from the Tan Lab were selected to be transformed using the RUBY construct, a red anthocyanin marker for transformation that allows events to be determined visually, rather than through typical antibiotic selection. The first method attempted for potato transformation involved cutting the stems of potato plants growing in soil and applying an Agrobacterium culture to the cuts. The lines used were W2x001-22-45 and ME2x0001-60. This method resulted in no successful transformations as there were no events that resulted in color change observed in any of the resulting plantlets. The second method used involved vacuum infiltration of tubers as a way of causing transformation. The lines used for this method were W2x001-22-45, ME2x0005-4, and ME2x0005-2. After the tubers were infiltrated, they were planted in perlite and grown out to see if red sectors appeared, which would indicate a transformation event.

838. Subglacial Water Storage in a Temperate Glacier System, Southeast Alaska

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Renée Clavette

Faculty Mentor: Seth Campbell

Abstract: Alaskan alpine glaciers contribute more to sea level rise than any other alpine glacier region on Earth, however, to better quantify the magnitude and timing of this contribution, we require a deeper understanding of the amount of liquid water stored within glaciers. The Juneau Icefield (JIF) represents the fifth-largest icefield in the world and is a temperate glacier system, therefore liquid water is prevalent throughout the snowpack, firn, and potentially in the subglacial environment. For this project, we aim to identify locations of subglacial water storage beneath a small ice basin (North Basin), on Taku Glacier, the largest glacier comprising the JIF. We employed common-offset (CO) ground-penetrating radar (GPR), conducting surveys during the 2023 summer, to investigate subglacial conditions such as ice thickness and liquid water content. Repeat GPR transects were also collected, providing temporal context for investigating variations in subglacial conditions. We found correlations between bed depth and basal return power, consistent with our understanding of radio wave propagation and power reduction.

839. Land Back Economics: A Sustainable Analysis of Hacienda Monarca

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Amelia Mooney, Hayley Raab, Diego Kulldorff, Luis Perales

Faculty Mentor: Sharon Klein

Abstract: Hacienda Monarca, a historic 37-acre ranch in Nogales, Arizona, has been recently acquired by Mexicayotl Academy of Excellence, a dual language, intercultural K-8 school along the U.S. Mexico border. The site was originally managed using an extractive agricultural model, but the academy seeks to transform it into a model for Land Back Economics and Sustainability. Working with the academy we created a three-part sustainability analysis for the site, including a written report, a three-phase development manual, and a poster presentation. A lens of indigenous ownership and traditional knowledge guides the focus of our work in land-back sustainability, sustainable energy and sustainable development. Our research and planning links traditional knowledge of the land with sustainable development and energy implementation. Aligned with the values and goals of the academy, we researched potential site modifications that prioritize appropriate and sustainable technologies that reduce environmental impacts. We also identified suitable knowledge models that help the academy integrate traditional knowledge with sustainable practice. Recommendations include the use of an edu-agrotourism model and traditional land-based practices, to maintain the site's agricultural heritage while prioritizing energy efficiency and renewable energy. The wide scope of this project required us to consider the broader impact development might have on the surrounding ecosystem, community, and economy. With an awareness of the site's culture, environment, community, and future goals, our analysis aims to provide the academy's instructors with information to create real-world learning experiences and key data to guide the board of directors in future development decisions of Hacienda Monarca.

840. Ocean Temperature Trends on the Scotian Slope spanning the past 11,000 years

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Devin Coffey

Faculty Mentor: Katherine Allen

Abstract: The evolution of ocean temperature during the Holocene, our current geologic epoch (11,700 years ago to present), remains poorly understood. Model simulations and proxy reconstructions of global, mean-annual Holocene surface temperature do not agree on the magnitude or even the direction of change, indicating that new work is required to resolve issues with existing models and/or proxies. A proxy is a parameter that can be measured directly by scientists today (e.g., magnesium content of microfossil shells) that may be used to estimate properties of the past ocean (e.g., seawater temperature). Today, subsurface waters travel along the Scotian Slope and enter the Gulf of Maine via the Northeast Channel. These slope waters are an important component of Northwest Atlantic circulation and knowledge of their Holocene evolution is key to resolving the long-term ocean-climate dynamics in this region. A sediment core collected from 1.1 km water depth on the Scotian Slope via a giant gravity corer is the focus of this study, which derives information on past environmental conditions from the geochemical composition of calcium carbonate shells preserved in the core. An age model using radiocarbon (^{14}C) was established for this site based on 5 samples (deriving carbon from fossil benthic foraminifera, gastropods, or bivalves), yielding sedimentation rates that ranged from 10 to 100 cm/ky. In addition, the stable isotope composition of benthic foraminifera (*Nonionellina labradorica*) was measured via isotope ratio mass spectrometry. The stable oxygen isotope composition ($\delta^{18}O$) of foraminiferal calcite is a function of both the temperature and isotopic composition of seawater. When combined with the trace element proxy of Mg/Ca, which is dominantly controlled by temperature, both ocean temperature and $\delta^{18}O$ may be constrained.

841. Molecular and Electronic Microscopical Investigations of the Distribution of Cryptic Polydora onagawaensis species along the Coast of Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Emma Tomasetti

Faculty Mentor: Paul Rawson

Abstract: Blister worms are polychaete worms that live in various calcareous materials such as dead shells, red algae, limestone, and cinder blocks, along with cultured shellfish, such as oysters or sea scallops. These worms can be considered a pest due to their nature to burrow into their host's substrate and create blisters that then fill with mud and detritus. I sampled various calcareous materials along shores at five downeast Maine locations: Lamoine Beach Park, Sipp Bay, Petit Manan, Jasper Beach, and Starboard Island to assess the distribution of Polydorid species. Past work in Maine locations found 3 cryptic species of Polydora onagawaensis that previously had not been recognized in Maine. To determine the species of worms found in the material I collected, I conducted phylogenetic analysis based on mtCO1 assessed via DNA isolation and PCR techniques. Based on my results to date all of the worms sampled from the five locations are specimens that belong to two out of the three cryptic species of P. onagawaensis I am also using morphological analyses, based on electron microscopy, to confirm the species identity of the worms I sampled. In my poster I will present the combined analyses based on both my molecular and morphological-based research.

842. The Science of Compost: An Assessment of the Impact of Bacteria Isolated From Food Scrap Compost on Crop Plant Growth

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Nnamdi Baker, Lindsey Bekele, Elijah Burns, Isabel Dionne, Brooke Fifield, Benjamin Flannery, Patience Goulette, Felicity Gregware, Anna-Cate Kuver, Sydney Roth, Sydney Shair, Tory Sweeney

Faculty Mentor: Jennifer Newell

Abstract: Cropping systems use potentially harmful synthetic fertilizers for plant growth, whereas composting is a closed-loop system that completes the cycle of nature and contributes to the ecosystem's health. Composting is not only a wonderful waste diversion technique, but it is also a source of beneficial microorganisms. It creates plant fertilizer, prevents soil erosion, and reduces greenhouse gases. Research has shown that the bacteria species found in compost benefits plant life. By isolating and culturing bacteria in compost, potato plants can be inoculated with the bacteria to determine the impact on plant development. By working to identify and culture beneficial bacteria, then the benefits of using compost over synthetic fertilizers could be evaluated for effectiveness in improving plant growth.

For this project, we will work in tandem with the BMB 210 Spring 2024 students as well as the Roger Clapp Greenhouses to grow food crops to determine if the isolated bacteria aid in growth. Bacteria samples are taken from student compost (n=5) weekly of different bacterial colonies. These bacteria were extracted from the compost, diluted to the power of 10-8, and tested against five antibiotics. Majority of bacteria tested showed susceptibility to ciprofloxacin while being resistant to the other antibiotics.

The goal is to isolate and culture bacteria that would benefit the growth of potatoes and can be grown in compost bioreactors. Having an understanding of which bacterial strains are tied to enhanced potato growth can form more sustainable agriculture practices on farms.

843. BMB 210: Measuring the Effects of Isolated Bacteria from Food Scrap Compost on Tomato Plant Growth

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Keagan Rice, Madison Alves, Tyler Fultz, Madison Goss, Trevor Lowe, Hayden Sargent

Faculty Mentor: Jennifer Newell

Abstract: Fertilizers are substances made up of chemical components such as nitrogen, potassium, and phosphorus that promote increased plant growth and soil fertility. Although there are many benefits to using chemical fertilizers, their overuse can lead to depletion of soil fertility and water pollution due to soil acidification, runoff, soil degradation, and elimination of soil bacterial diversity. The solution is composting. Composting is a method where organic waste material is decomposed and recycled into fertilizer for soil. The microbiome in compost mediates waste decomposition to produce nutrients beneficial for the health of the soil. The purpose of this experiment is to isolate and characterize bacterial species from compost and add them to tomato plants to monitor the effects each strain has on the growth of tomato plants.

Tomato plants were chosen since a 2023 National Garden Association survey found that around 86% of home vegetable gardeners grew tomatoes. We set up bioreactors with food scraps and various brown materials and monitored the weekly condition of the compost. We then collected samples and ran antibiotic resistance tests and biochemical tests to help identify the properties of the bacteria. DNA extraction and PCR were then used to identify the species of bacteria.

We hope that determining bacterial species useful in tomato plant growth will shed more light on the benefit of organic fertilizers over chemical fertilizers. The use of organic fertilizers can lead to sustainable agriculture practices on farms without the negative harm associated with chemical fertilizers.

844. Iolite Data Reduction for LA-ICP-MS Use on Ice Core Samples

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Samantha Baumgartner, Elena Korotkikh, Michael Handley, Paul Mayewski

Faculty Mentor: Andrei Kurbatov

Abstract: We report testing of Iolite, a data processing software, for Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS). Data reduction schemes will be used in the processing of ice core sample data. By refining an existing method, data reproducibility in the W. M. Keck Laser Ice Core Facility in the Climate Change Institute would be enhanced. An improved method involves adaptation of the Iolite software to calibrate ice core samples and map impurity locations. Current data processing used in the LA-ICP-MS Keck laser facility is time consuming and involves several manual steps for data reductions. The Iolite software provides automated features that allow: easy selection of the baseline, standards, and samples, built in data reduction schemes, the ability to create standards for data reductions, and the creation of templates for rapid sample processing. Consolidated selections such as these permit rapid processing and ease of exporting data. In addition, Iolite utilizes Python plugins which allow the user to implement additional processing algorithms if a feature isn't included in the base software. Upon successful implementation of an Iolite based data processing routine, the anticipated outcomes include traceability and transparency of all data processing steps and an enhancement of data reproducibility.

845. The Relationship Between Extreme Precipitation And Stable Isotopic Values

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Muhammad Drammeh

Faculty Mentor: Karl Kreutz

Abstract: Extreme precipitation is an issue that historically heavily affects agricultural industries and coastal communities in New England and Maine, and continues to do so. Previous studies have attempted to track the causes of extreme precipitation in New England, but have not been able to explain the specific upwards trend in extreme precipitation in the region during the winter. This study aims to use stable isotopic values to determine a causality behind this trend. Using MATLAB, we compared the Bangor International Airport and Roger's Farm GHCN-d stations to ascertain the correlation in precipitation values during extreme events, finding no correlation, implying that extremity for these stations is largely a local event. We additionally compared these stations to CoCoRAhs stations, finding little correlation due to gaps in data and spatial variation. We now aim to compare extreme precipitation events in the Bangor International Airport and Roger's Farm datasets to stable isotopic samples in their respective regions. The findings produced by this study have the potential to allow us to better understand the specific mechanisms by which extreme precipitation events occur within the New England region and address its effects on coastal and agricultural communities.

846. Black Soldier Fly Larvae Meal as a Partial Protein Replacement in Formulated Larval Finfish Diets

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Meredith Ward

Faculty Mentor: Matt Hawkyard

Abstract: Rapid expansion of aquaculture in recent decades has allowed this industry to meet the growing global seafood demand, however it is important that future growth in this sector is accomplished sustainably. Because of this, insect meal is rising in popularity as a protein replacement for fishmeal, which is commonly used in formulated finfish diets and is in limited supply. The objective of this research was to evaluate the effects of microparticulate diets produced with black soldier fly larvae (BSFL; Stratium, Buffalo. NY) meal on the growth and survival of marine fish larvae. All experimental diets were based on an open-formula reference diet (OFRD) developed for marine fish larvae. The benefits of the OFRD is that it allows direct comparison with related studies and can be used by commercial feed manufacturers for product development and formulation. In this study, experimental diets were formulated containing Stratium black soldier fly meal as a partial (50%) replacement of the marine ingredients and a total replacement of krill meal from the OFRD on a crude protein basis. Experimental diets were characterized and then used in a feeding trial with 20 day post hatch (dph) Inland silversides (Menidia beryllina). This species was chosen because it is an EPA approved estuarine species used in bioassays and allows for low cost and rapid research progress.The feeding trial was conducted over a course of 10 days, with feedings occurring twice daily in the morning and evening. If successful, this research could provide further data supporting insect meal as a viable replacement for fish meal as a source of protein.

847. Fermentation of Brewer's Spent Grain with Rhizopus Oligosporus

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Adoum Fadaya Arabi

Faculty Mentor: Denise Skonberg

Abstract: Brewer's spent grain (BSG) is a byproduct of commercial beer-making. Considered as a waste product, it is mainly used as animal feed or disposed of in landfills. This research aimed at upcycling BSG through fermentation to create a novel product for human consumption similar to soybean tempeh. This will help reduce food waste and contribute to creating a nutritious and functional food ingredient.

Three types of BSG (light, medium, dark) were collected from local craft breweries immediately after production. Samples were inoculated with the edible fungi Rhizopus oligosporus at 104 spores/g BSG and fermented for three days at 37°C. BSG type and fermentation treatment were the independent variables tested, and treatments were processed in triplicate. Physicochemical and microbial analyses were performed before and after fermentation to evaluate any changes that occurred and differences among treatments were evaluated by ANOVA ($p < 0.05$). Moisture, protein, mineral content, soluble protein content and antioxidant capacity were analyzed. Microbial analyses included total aerobic count, coliform and Bacillus cereus counts.

Fermentation of BSG successfully produced a tempeh-like product with enhanced nutritional content. Fermentation increased the total protein content of the BSG from 19.1 to 23.6 g/100g. The antioxidant capacity as measured by total phenolic content and ability to scavenge free radicals was also significantly increased by fermentation. BSG tempeh is a viable and promising upcycled food for human consumption, but further research is needed to elucidate more of its functional and nutritional potential.

848. SKN-1 as a Regulator of Partridgeberry Extract Antioxidant Properties in C.elegans

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Daniel Joy

Faculty Mentor: Jennifer Newell- Caito

Abstract: Mitchella repens, or partridgeberry is a plant that is native to eastern North America and has an extensive history within the medicinal practices of Indigenous tribes. Historical records indicate Indigenous Americans treated childbirth pains, rheumatism, and back pain with tea created from their leaves. Previous research has indicated that the berries of partridgeberry are rich in polyphenols, a known antioxidant. Antioxidants provide extensive health benefits by balancing free radicals created from oxidative stress. Too much oxidative stress induced by the heavy metal manganese (Mn) plays a critical role in the development of age-related neurodegenerative diseases. To address how partridgeberry berry extract (PBE) may counteract oxidative stress, nematode worms, Caenorhabditis elegans, were chosen to examine the effects of PBE as an antioxidant against manganese-induced oxidative stress due to its short life span which is beneficial for treatments being 48 hours as well as previous studies that indicated oxidative stress due to Mn exposure. Wildtype N2 C. elegans and worms with an overexpression (OE) and knockout (KO) mutation to the gene encoding skn-1 were treated. skn-1 is a transcription factor required for response to oxidative stress; skn-1 activation induces the expression of genes involved in the oxidative stress response in the worms and regulates lifespan extension. skn-1 mutants show decreased resistance to oxidative stress and shortened lifespan, while over-expression of a mutant skn-1 increased resistance to oxidative stress and increased longevity. Several dose-response survival curves were created from worms pre-treated with increasing concentrations of manganese for N2 as well as both skn-1 KO and OE worms. In the presence of increasing Mn concentrations the LD50, resultant lethal dose where 50% of the worms were killed, was calculated to be 33 mM for N2 worms and 102 and 21 mM for skn-1 OE and KO, respectively. Antioxidant potential of PBE was assessed by pre-treating C. elegans with PLE (1, 5, and 25%) for 30 minutes, followed by exposure to Mn for 30 minutes. Our findings indicate that PLE produced a protective effect in the skn-1 KO worms, but had no additional protection in skn-1 OE. These results suggest that overexpression of skn-1 results in a protective effect by reducing oxidative stress that cannot be amplified by PBE. Since manganese is implicated in neurodegenerative disease, future studies should explore the use of PBE on Mn-induced oxidative stress to dopaminergic neurons.

849. Antioxidant Algae: An Investigation into the Antioxidant Properties of Seaweed Through the Lens of Wabanaki Knowledge and History

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Emily Perilla

Faculty Mentor: Jennifer Newell- Caito

Abstract: For many generations, Wabanaki communities including the Mi'kmaq, Maliseet, Passamaquoddy, and Abenaki peoples have harvested red algae and other sea vegetables for a variety of uses. Indigenous knowledge has long been appropriated, excluded, and seen as only anecdotal, though Indigenous knowledge is backed by generations of observation, experience, and research. The objective of this study is to investigate the antioxidant properties of algae while emphasizing the previous knowledge held by Indigenous peoples and exploring the relationship between Wabanaki people and seaweed. Acetone extractions of the seaweeds, Palmaria palmata (dulse), Fucus vesiculosus (bladderwrack), and Porphyra umbilicalis (laver) were performed in triplicate using 10 grams of dried seaweed in each preparation. Total phenolic content was assessed in each extract using gallic acid as the standard. We anticipate that our research will reveal that dulse, bladderwrack, and laver contain salient levels of polyphenols and could contain potential antioxidant activity. Results will contribute to the future use of seaweeds as a source of nutrients and antioxidants as well as emphasizing Indigenous epistemologies of sustainable harvesting, knowledge transmission, and understanding of the land.

850. Quantifying the "Perfect Storm" for Sediment Entrainment at the Confluence of Nontidal Streams and Tidal Estuaries

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): David Libby, Bea Van Dam

Faculty Mentor: Sean Smith

Abstract: Sediment mobilization by moving water has implications to aquatic habitats, water quality, public safety, and human health in waterways of Maine. The association of bacteria with sediment is one case where mobilization of particles by water flow can influence decisions related to closures of shellfish harvesting with implications to public health and wellbeing in coastal Maine communities. Previous research indicates bacteria can be absorbed to sediment particles, causing contamination beyond acceptable limits enforced by coastal resource managers in locations where particle entrainment occurs. The prediction and quantification of sediment entrainment in locations at the confluence of freshwater streams and estuary mud flats is challenging because of the variable conditions related to precipitation events, stream flow, and semidiurnal tidal fluctuations throughout the year. This research focuses on the convergence of conditions when sediment entrainment with contamination outcomes are most likely to occur in the confluence areas.

Our study location is the confluence of Crippen's Brook with the Jordan River estuary in Trenton, Maine. We describe and evaluate conditions coincident with relatively high vulnerability to sediment entrainment in the intertidal confluence area based on time series of stream flow and tidal conditions. Channel bottom sediment grain size and topographic measurements at the intertidal confluence are used with the time series data to perform analyses of the hydraulic conditions conducive to sediment mobilization. The analyses, performed at hourly time steps, are designed to identify and describe vulnerability to sediment mobilization, including the frequency that the conditions can become established in similar types of confluence settings. This research helps address a knowledge gap related to coastal sediment dynamics and a mechanism of contamination at the confluence of nontidal streams and tidal estuaries in Maine.

851. Temporal and Spatial Precipitation Chemistry of Puerto Rico and US Virgin Islands

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Bez Warren, Amanda Olsen, Thomas Korstanje, Jody Potter, Bill McDowell

Faculty Mentor: Amanda Olsen

Abstract: Precipitation chemistry has been studied in northeastern Puerto Rico for decades (McClintock, 2019); however, few studies have addressed precipitation trends across the island. With the addition of the new precipitation monitoring programs at three NEON sites in central and southwestern Puerto Rico, it is now possible to examine trends in precipitation chemistry temporally and spatially across Puerto Rico. We examine trends in Ca, K, Na,Mg, Cl, NH4+, NO3 -, SO4 2-, and PO43- six sites in Puerto Rico: the Guanica Forest, Rio Cupeyes, and Rio Yahuecas NEON sites, the National Atmospheric Deposition Program's (NADP) El Verde site, the Luquillo Long Term Ecological Research's at El Verde site, and a monitoring site adjacent to the urban Rio Piedras in the San Juan metro area. We also compare these to an additional NADP U.S. Virgin Islands monitoring site in Virgin Islands National Park. Samples from all the sites were collected using wet-only disposition collectors, which consist of an automated climate-controlled assembly that begins collecting once precipitation is detected and closes when precipitation ceases, thereby eliminating input due to dry deposition between precipitation events. Sampling dates range from 2018 to present.

Bibliography

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852. An Anionic Exchange Resin Can Sequester Perfluorooctane Sulfonic Acid (PFOS) under in Vitro Ruminal Conditions

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sarah Benner, Kizito Nishimwe, Ana Paula Jimenez Lagos, Andre Mindiola Mendoza, Lilian Nowak

Faculty Mentor: Juan Romero

Abstract: The aim of this study was to evaluate the efficacy of potential binders in sequestering PFAS (per- and poly-fluoroalkyl substances) under simulated ruminal conditions using contaminated grass (PFOS: 10 ± 1.72 µg/kg; DM basis). Binders included clay binder 1 (CLY1) and 2 (CLY2), polysaccharide binder (PLS), carbonaceous binder (CRB), and anion exchange resin 1 (AER1), and 2 (AER2). PFAS-contaminated grass (3g) was mixed with 0.05g of each binder (except AER 1, 0.01g) before adding 100 mL of rumen media. ANKOM bottles were shaken at 60 rpm for 48 h at 39°C. The percentage of PFOS binding affinity of the respective binders was calculated in relation to the control (CON). A randomized complete block design (n= 4) was used to analyze the data using SAS v.9.4. Differences were declared at $P \leq 0.05$. Only AER2 was found to bind PFOS under ruminal conditions, with a relative binding of 52.5 ± 8.59%, which was higher than any other binder tested. The asymptotic maximum gas production (x =132.4 ± 10.9 mL/g of DM), rate of gas production (x= 3.37 ± 0.23 %/h), ammonia-N (x= 9.96 ± 2.27 mg/dL) and total volatile fatty acids (x= 121.34 ± 5.6 mM) was not affected by binder type. However, propionic acid was lower in AER-1 vs. CON (27.6 vs. 28.3 ± 0.16%). In conclusion, AER2 was the only binder that effectively sequestered PFOS under in vitro ruminal conditions, and it did so without negatively affecting ruminal gas production kinetics and microbial fermentation.

853. Evaluating Native Bog Birch for Horticultural Production in a Changing Climate

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Jessica Hutchinson, Stephanie Burnett

Faculty Mentor: Bryan J. Peterson

Abstract: Selecting native plants that can adapt to predicted changes in climate is a way to preserve and strengthen landscape biodiversity and resilience in ornamental landscapes. To investigate the potential of bog birch (Betula pumila) for use in horticultural landscapes, we evaluated methods to propagate this novel Maine native wetland shrub. We also investigated the physiological responses to water deficit, a condition expected to increase in frequency and duration as climates change. In July 2023, we collected softwood stem cuttings of wild bog birch, treated them by dipping them into water or indole-3-butyric acid (K-IBA), and evaluated their root systems after being under intermittent mist. Cuttings treated with any concentration of K-IBA from 1,000 to 5,000 ppm yielded 69% transplantable cuttings, while cuttings treated with water produced inferior measures of rooting. In a second study, we imposed a controlled drought on 1-year-old bog birch growing in #1 nursery containers. Drought severity was increased weekly using Arduino microcontroller irrigation systems in a greenhouse to decrease volumetric water content (%). Bog birch survived moderate drought, and maintained their aesthetic value at substrate moistures as low as 10%. Under severe drought (5%), shrubs lost a significant portion of foliage, yet remained alive. Bog birch can be propagated easily from stem cuttings, grows well in containers, and maintains aesthetic features under moderate drought conditions. Results support future consideration for bog birch as a native ornamental shrub in Maine. This broadens the selection for consumers as Maine shifts towards climate conscious ornamental landscapes that support biodiverse ecosystems.

854. Assessing Maine's Bird Species in Relation to Forestry Practices

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ethan MacKenzie

Faculty Mentor: Sabrina Morano

Abstract: Maine's native woodland bird species play a variety of crucial ecological roles within their forest ecosystem. These roles include serving as indicator species of the forest's overall health, regulating insect populations, dispersing native seeds, and contributing significantly to fostering biodiversity. However, forested systems are constantly undergoing transformations due to forestry management practices and resulting harvest treatments. Forestry practices are not inherently harmful to the native bird populations, as different harvest treatments can lead to variation in forest types and structure. Understanding the impacts that forest management practices might have on bird populations is a topic that needs to be studied and evaluated. Using data provided by the Cooperative Forestry Research Unit (CFRU) we will create a series of indices to identify bird species richness, diversity, and abundance in 8 research sites from 2023, and a comparative 6 sites from 2022. Treatment types range from clear-cutting to low-impact selective cuts, reflecting a spectrum of approaches that foresters may take depending on their overall goal or intended use of the land. We aim to identify how these indices vary among the forest management practices. We expect that treatments within sites that are subjected to lower levels of harvesting will exhibit a higher bird species richness, while treatments within the same sites that are subjected to higher levels of harvesting will exhibit a higher bird species diversity. This information will aid in understanding how forest management practices might influence bird communities within Maine and can provide information to improve or maintain bird diversity.

855. Chemical Gradients and the Mobility of Major and Trace Elements in Weathering Rinds of Serpentinites

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Gwenivere Watkins

Faculty Mentor: Amanda Albright Olsen

Abstract: Serpentinites are metamorphic rocks that form through hydrothermal alteration of igneous rocks that are high in iron and magnesium. They have a low calcium to magnesium ratio, low concentrations of vital plant nutrients, and high concentrations of trace metals such as nickel, chromium, and cobalt that can be toxic to plants and animals. When serpentinites react with water, they break down through chemical weathering, which forms soils and releases elements into natural waters. Because of the abundance of toxic trace metals in serpentinite, serpentinite weathering can affect soil and water quality. To understand the release of trace metals during serpentinite weathering, we used laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) at Oak Ridge National Laboratory to analyze weathered serpentinite samples. Our samples are from the Trinity ultramafic body in northern California, from Scorpion Creek and Kangaroo Lake in the Klamath Mountains, and from the Pine Hill Serpentinite located on Little Deer Isle, Maine. We made chemical maps of weathering gradients for major and trace elements to track elemental mobility during weathering. The chemical maps of the samples in some areas show subtle trends that follow the expected weathering behavior of relative enrichment of aluminum and depletion of magnesium from the core to the outer edge of the sample, while other parts of the samples do not show any clear trends.

856. Species Diversity, Resilience, and Sustainability in Aquaculture: A Review of the Literature

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sebastian Crapa

Faculty Mentor: Neil Greenberg

Abstract: The aquaculture industry has grown to be a key part of the global food system, and as it has grown the industry has changed. New species have periodically been introduced and experimented with, and the success of some has led to a substantial portion of aquaculture production coming from just a few species. This review examines studies that have focused on species diversity in aquaculture in order to form an understanding of the causes of production being concentrated within a few species and the existing views of species diversity in general. These studies have focused on quantifying diversity, the connection to productivity, methods of diversifying aquaculture systems, and the role of diversity in sustainability of the aquaculture industry. Across several papers, there was a consensus that species diversity is important to the resilience and sustainability of the industry. Several papers also identified technological and economical factors as limitations in establishing new species in aquaculture, which perpetuates the dominance of a few species. These species are further supported by having more developed infrastructure and technology to support aquaculture, as well as having more predictable markets to make them more attractive to newly established aquaculture operations. Government regulations were also identified as a factor controlling diversity as regulations can inhibit or encourage diversity. Forms of polyculture were often discussed as an avenue for diversification with additional benefits to sustainability.

857. Quantifying IgM Response in Atlantic Salmon

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Josephine Oarr

Faculty Mentor: Sarah Turner

Abstract: Antibodies, or immunoglobulins, are proteins that act to protect the body against foreign substances as part of the immune response. Antibodies bind to a specific portion of the pathogen called the antigen. IgM, or immunoglobulin-M, is one of the three major types of immunoglobulin isotopes found in teleost fish and is the major systemic antibody in Atlantic salmon (Hordvik, 2015). IgM antibodies in farmed salmon serum can increase in response to successful vaccination (Kamil et al., 2013). In this study, 360 Atlantic salmon were vaccinated with four novel vaccine formulations and four positive and negative controls in triplicate tanks against a bacterial pathogen impacting salmonids. At 300- degree days and 600- degree days post vaccination, 10 fish from each replicate treatment group had blood collected for serum. Enzyme-linked immunosorbent assays (ELISA) were used to detect IgM levels in Atlantic salmon serum collected during the baseline, 300-dd, and 600- dd sampling days from each of the treatment groups. ELISA assay results indicate serum antigen specific IgM endpoint titers were numerically higher in all vaccinated groups compared to the negative controls, however increases were not all statistically significant, necessitating further testing. Vaccination plays a big role in preventing disease outbreaks in aquaculture and aquaculture is necessary as a sustainable way to feed populations without depleting wildlife resources (Frans et al., 2011). Vaccination is therefore crucial for aquaculture industries as a way to ensure sustainability and food production.

858. Investigating the Effects of Soil and Plant Characteristics on Soil-to-Plant PFOS Transfer Factors in Perennial Forage Systems Across Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Sonora Ortiz, Jean MacRae, Thomas Simones, Andrew Smith

Faculty Mentor: Ellen Mallory

Abstract: Perfluorooctane sulfonic acid (PFOS) is an emerging health risk linked to carcinogenic and immunotoxic effects, among others. A major route of human exposure is through milk and beef from cows fed with hay contaminated as a result of historic sludge spreading on farm fields. Soil-to-plant transfer factors, quantifications of PFOS uptake by plants, are highly variable from site to site and even field to field on a given farm. In this study, we sought to find connections between various soil and plant characteristics and this variability in transfer factors from 25 sites across Maine. Some of the soil parameters considered include texture, pH, and total organic carbon; some of the plant parameters include crude protein, lignin, and starch. Co-located soil and plant samples were taken and submitted for PFOS, soil fertility, and forage quality analyses. PFOS levels were determined using the Department of Defense Quality Systems Manual 5.1 (DoD QSM 5.1) method with plant samples undergoing cryogrinding prior to analysis. Soil fertility tests included those using the Mehlich 3 extractant. Forage quality analysis was conducted using near-infrared spectroscopy. A combination of standard statistical analysis as well as principal component analysis was used on the data. Preliminary results suggest that the concentration of exchange sites in the soil explains the largest portion of the variability in our data set and is negatively related to PFOS transfer factors.

859. Protective Effects of Winterberry (Ilex Verticillata) on Caenorhabditis Elegans with Manganese-Induced Toxicity

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Leah Mastrianno

Faculty Mentor: Jennifer Newell Caito

Abstract: The leaves of the winterberry (Ilex verticillata), have been used by the Indigenous tribes of Northeast America in medicinal teas. The genus Ilex is known to have leaves rich in antioxidants, specifically polyphenols. In humans, polyphenol rich diets have been shown to reduce the risk of cardiovascular and neurodegenerative diseases. Previous research involving winterberry leaf extract (WLE) shows that WLE provided antioxidant protection in manganese-treated C. elegans. This project aims to elucidate the biochemical pathways of how WLE acts as an antioxidant in C. elegans. The skn-1 gene, an ortholog to the human Nrf2 gene, is involved in the oxidative stress responses. The effect of WLE extract was tested in wild type N2 worms, and in both overexpression and knockout skn-1 strains. These worm strains were treated with 0.1%, 0.5%, 1% WLE and increasing concentrations of $MnCl_2$ in survival curve assays. LD50 values will be obtained and compared to that of wild type worms. It is expected that protection from WLE will be increased in knockout strains treated with $MnCl_2$, and the overexpression strains will confer additional protection.

860. Trust in Science and Institutions Among Residents of Maine

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Melissa Godin, Charity Zimmerman

Faculty Mentor: Caroline Noblet

Abstract: Trust in institutions and scientific research is critical to creating, implementing, and evaluating public policy. Erosion of trust in science can fuel policies and personal decision-making that are based on misinformation and vested interests rather than factual evidence. The continuation of scientific research is also largely contingent upon public funding and confidence. National opinion polls conducted by the Pew Research Center show that in the United States trust in science, scientists, and public institutions has declined since the COVID-19 pandemic in 2020, particularly among certain demographic groups. Utilizing survey data collected by Dr. Caroline Noblet, Associate Professor of Economics at the University of Maine, we will compare attitudes and opinions of Maine residents regarding trust in science to these national trends. We will also examine whether demographic variables such as education level, socioeconomic status, age, and others influence trust in science and institutions in Maine. Preliminary results show that there was a post-COVID decline in trust among Maine residents. However, recent survey data also suggests that state agencies, universities, and nonprofit organizations maintain higher levels of trust regarding science-based topics when compared to federal agencies among Maine residents. Understanding the factors that shape trust in science can equip researchers and policymakers with valuable insights to improve their communication and engagement with the public.

861. Effects of a Caddisfly Range Shift on Competition and Facilitation in High Elevation Ponds

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ava Ardito

Faculty Mentor: Hamish Greig

Abstract: As temperatures warm, the climate crisis is having a significant influence on species all across the world and altering their distributions. Colorado's high elevation ponds have recently observed a species range shift, traveling to higher altitudes than they have previously inhabited. The Mexican Cut Nature Preserve near the Rocky Mountain Biological Laboratory (RMBL) in Gothic, CO, is home to a prominent caddisfly Limnephilus externus, but recently a new range-shifting species, Nemotaulius hostilis, has appeared. Caddisflies play an essential role in nutrient cycling and putting energy back into the food web. The range-shifting species is known to excrete high rates of phosphorus (P), and could potentially facilitate the growth of a nutrient dense food source for the resident species. However, the range-shifting species and the resident species have differing life histories and emergence patterns that may increase interspecific competition between the two caddisfly populations. In addition, this study explores nutrient cycling and biogeochemical interactions, and therefore increases our understanding of whether changing assemblages of invertebrates play a role in mitigating increased nutrient loads in aquatic ecosystems. This study aims to understand the ecological impacts that range-shifting species are having on their newly inhabited ecosystems.

862. Reading Between the Hydrograph Lines: Analyzing Measured Flows to Inform Penobscot River Restoration

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): R. Cade King, Bea E. Van Dam

Faculty Mentor: Sean M.C. Smith

Abstract: Civil infrastructure related to freshwater flows is often constructed to meet industrial, recreational, and hazard management demands. Structures such as dams and canals can enhance surface water storage, create water supply sources, generate energy, and regulate flood flows to manage hazards. However, the constructed features can alter hydraulic conditions in river channels by reducing responses to runoff and changing hydrologic regimes. This can impact aquatic habitat for vulnerable organisms like diadromous fish. In the 19th and 20th centuries, dams, canals, and sluiceways were constructed throughout Maine's Penobscot River system to transport copious quantities of logs and produce power. Today, the drainage network of the Penobscot's East Branch remains dammed in multiple locations, and flow from the headwaters of the St. John River is rerouted into the East Branch through the Telos Canal.

Modern management decisions regarding the future of the Penobscot's headwaters require consideration of this infrastructure, aquatic habitat impairments, societal needs, and forecasted climate changes. Assessment of infrastructural impacts and quantification of the river's responses to restoration scenarios is required for stakeholder-led restorative action. Hydrologic and hydraulic conditions in the Penobscot's East Branch are being simulated using the US Army Corps of Engineers' HEC-RAS and HEC-HMS modeling platforms. The simulations consist of comparative responses to varied habitat restoration scenarios involving a range of dam management alternatives. Here, we summarize preliminary research outcomes focused on assembly of knowledge, spatial information, and hydrologic measurements related to the East Branch in the context of multi-objective river management interests.

863. Optimum Nitrogen Management In Organic Dry Bean Direct Seeded Into Roll Crimped Cereal Rye Mulch

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Madeline Hunter, Mathew Ryan, Heather Darby, Tom Molloy, Sarah Pethybridge, Erin Silva

Faculty Mentor: Ellen Mallory

Abstract: Organic agriculture typically relies on heavy tillage to manage weeds, which can degrade soil health. Planting into a mulch of roller-crimped cereal rye has been used successfully with organic soybeans as an alternative weed suppression method that also maintain soil structure. However, for dry beans, which are relatively poor N fixers, low soil inorganic nitrogen (N) following rye has been shown to limit growth. N fertilization may be able to overcome this but research is needed to understand optimal N fertility strategies (timings and rates). Starting in 2023, research will be conducted in Maine, Vermont, Wisconsin, and New York to identify N application timings and rates that optimize rye mulch biomass and dry bean performance. Treatments include four tillage and fertility sytems (tilled, no-till with fall-applied N, no-till with spring-applied N, and no-till with split N applications) fertilized at 5 different N rates. Rye growth (in no-till plots), bean performance, weed suppression, and soil health parameters will be assessed for each treatment. We expect that although beans may need greater fertility in no-till treatments, the roller-crimped rye mulch will increase weed suppression and soil health compared to the tilled system. These effects will most likely be greatest in fall N treatments due higher fall fertility causing increased rye biomass (and therefore weed suppression). We expect to see greatest yields in the split N treatments, as these have the combined benefit of greater weed suppression from fall applications and added fertility for optimum dry bean growth in the spring.

864. Genesis of Antimony Deposits in Carmel, Maine, USA

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Eyan Fennelly

Faculty Mentor: Martin Yates

Abstract: Antimony occurrences have been documented in the vicinity of Carmel, Maine as early as 1861. The Carmel Antimony Mine was briefly operated during the early 1880's, and reported relatively rich amounts of the mineral stibnite, however the location of the mine was largely unknown until its rediscovery by the author during the summer of 2023. The US Department of the Interior has identified antimony as a critical mineral (essential to national security and economic prosperity) and its imports are susceptible to political disruption. There has been no research into the genesis of this deposit, providing a unique opportunity to examine its depositional environment. This deposit represents hydrothermal mineralization along a fracture, hosted primarily by quartz-dolomite veins within a quartzite host rock. The stibnite is also hosted within a body of a siderite-magnesite replaced amphibole and dolomite matrix that was historically misidentified as quartzite. Analysis of the mineral evolution of the deposit via electron microprobe shows complex relationships between stibnite, tetrahedrite, sphalerite, pyrite, arsenopyrite, and rutile, along with many other gangue minerals (i.e., minerals that have little to no economic value within an ore rock) that may represent multiple mineralization events. Cross-cutting relationships and observations of mineral inclusions allowed for relative aging of the economic minerals in the deposit. The host rocks of the deposit are presumed to be interbedded within Silurian aged calc-turbidites of the Hutchins Corner Formation, with all rocks in the area having been regionally metamorphosed to greenschist facies during the Acadian Orogeny.

865. Development of an Innovative Whey Protein Recovery Process Utilizing Seaweed Extracts

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Alex Pierce

Faculty Mentor: Qing Jin

Abstract: Whey is the largest byproduct generated from the cheese-making industry. About 9.9 million pounds of liquid whey is produced by Maine's cheese manufacturers every year. Currently, there is not an easy way for small and medium-sized cheese producers to utilize this byproduct themselves. This project focused on the development of a simple process using polysaccharides derived from farmed seaweed, a growing industry in Maine, to enable these cheese manufacturers to efficiently capture whey protein. The pH (3-6), seaweed polysaccharide type (alginate, carrageenan, seaweed crude extract), concentrations (0.5-5 g/L), and flocculation time (1 and 3 h) were evaluated to optimize whey protein recovery. Our results showed that pH at 4.5 was the most effective for precipitate whey protein. Adding polysaccharides further supported whey protein recovery. At optimal conditions (concentration of 3g/L and flocculating time of 3 hours), carrageenan, alginate, and crude seaweed extract showed protein reductions of 82%, 68%, and 65%, respectively, which was higher than that (7%) of pH adjustment. In addition, carrageenan, alginate, and crude seaweed extract also showed turbidity reductions of 51%, 59%, and 48%, respectively, which was higher than that (1%) of pH adjustment. Protein functionality tests for gelling capacity, emulsion stability, and water- and oil-holding capacity were also performed. Implementing this innovative approach can assist cheese producers in Maine, boosting their profit margins and reducing environmental waste. Moreover, integrating seaweed extract into cheese production presents an opportunity to develop value-added products, benefiting both the seaweed and cheese industries.

866. Comparing the Feeding Selectivity of Larval Lobster Stages on High-Calorie Copepod Prey through rtPCR DNA analysis

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Tessa McCarthy, Alex Ascher, Pete Countway, Maura Niemisto, David Fields, Richard Wahle

Faculty Mentor: Richard Wahle

Abstract: Ocean warming and changes in the North Atlantic circulation have led the Gulf of Maine to be one of the fastest warming bodies of water in the world. These disturbances created ecosystem-wide effects, including diminished phytoplankton and zooplankton productivity, that have implications for the region's fisheries. Over the past decade, recruitment of American lobster from the planktonic larval stage to benthic young-of-year juveniles has declined. Because young-of-year recruitment determines subsequent recruitment to the fishery, understanding the drivers of larval survivability has become the focus of recent research. My research contributes to a larger collaboration evaluating the hypothesis that larval lobster survival is limited by the supply of planktonic foods. Previous research has shown that larval lobster survival to the postlarval stage is highly correlated with the abundance of *Calanus finmarchicus*, an energy rich copepod that is foundational to the Gulf of Maine zooplankton assemblage. Over a decade of warming temperatures has led *C. finmarchicus* numbers to decline. Recent rtPCR DNA analysis of postlarval lobster stomach contents collected in coastal Maine suggest that postlarvae feed selectively on *C. finmarchicus*. To date, the same analysis has yet to be done on the earliest stage larvae (Stage I) that would be most vulnerable to food limitation. By the same DNA sequencing technique, I determined that Stage I larvae from the same collections also consumed *C. finmarchicus*. Through concurrent vertical plankton tows, my results provide evidence that Stage I larval lobsters also consume *C. finmarchicus* selectively, but at a comparatively lower rate to postlarvae.

867. Establishing Chronologies for the Outlet Glaciers of the Juneau and Kluane Icefields, Western North America

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): George Swenson

Faculty Mentor: Aaron Putnam

Abstract: Glaciers in NW Pacific region exert an outsize impact on sea level, the surrounding landscape, ecosystems, and water sources in response to atmospheric warming. Paleoglaciology can provide useful context for evaluating ongoing warming and glacier recession within the context of past natural variability. Here I propose to develop a chronology for how glaciers of the SE Alaska region have fluctuated during the last several millennia prior to the industrial period. These glaciers have a large impact on the surrounding landscape, ecosystem, and water sources depending on their changes in size, resulting from fluctuations in prevailing local climate. Glaciers are highly sensitive monitors of atmospheric temperatures, and the glacial geomorphologic record contains direct physical evidence for glaciers advance and recession in response to natural climate variations during the pre-Industrial Holocene. I aim to address the following questions: 1. What were the patterns and causes of natural glacier and climate variability during the Holocene in Alaska's glaciers along the NW Pacific? 2. How does the rate and magnitude of ongoing glacier recession in the NW Pacific compare to past intervals of climatic warming and glacier melt?. Here, I propose to employ Beryllium-10 (10Be) surface-exposure dating and radiocarbon-dating (14C) techniques to develop chronologies for the Holocene history of glacier fronts in the Juneau Icefield region and in Kluane National Park, Yukon, Canada. I will use 10Be dating to develop exposure histories of moraine boulders and recently deglaciated bedrock to establish the timing of recent glacial maxima and past episodes of glacier recession, respectively. In addition, we will apply 14C dating to recently exposed glacially sheared wood to establish the timing of past glacier advances. These data should afford new insights into the glacial history of this important region.

868. Bonaire: A Beacon of Positive Change in a Shifting Climate

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Nicholas Cavalieri

Faculty Mentor: Robert Steneck

Abstract: Coral reefs are declining globally due to coral bleaching and disease. Juvenile corals provide a way reefs can recovery. In 2023, I quantified the distribution, abundance and species composition of juvenile corals in Bonaire (Dutch Caribbean) using the same methods and locations that have been used for the past 20 years. Specifically, there were 11 study sites along the western coast of Bonaire. Between 2003 and 2009, the juvenile coral abundance had been declining. In 2010, coral bleaching killed over 20 % of Bonaire's corals on the 11 monitored coral reefs, juvenile densities remained low in 2011 but have been increasing since 2013 with. 2023 having the second highest juvenile coral population density since 2003 when the monitoring of Bonaire's coral reefs began. . Agaricia agaricites was the most abundant, and Porites astreoides was the second-most abundant species on the monitored reefs . Bonaire’s juvenile coral densities were much greater than those from similar long-term monitoring programs on neighboring islands. Bonaire has exceptionally great abundance of herbivorous parrotfish that remove harmful macroalgae making the reef more receptive to juvenile corals. These findings underscore the importance of local management in shaping coral reef dynamics and emphasize the need for collaborative conservation efforts to address common challenges and promote reef resilience across the Caribbean.

869. Expression of Heat Shock Protein 20 in a Stressed Soft Coral, Anthelia glauca

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Carly Balfe

Faculty Mentor: Ian Bricknell

Abstract: One of the most widely known issues facing tropical coral reefs is mass bleaching events, leaving large percentages damaged or dead. Less discussed is how vacant reef sites are re-colonized by other corals. The first corals found to resettle on reefs are the soft octocorals such as Anthelia glauca., – known to grow in large, clonal colonies. These corals grow rapidly and prevent the settlement of slower-growing stony corals after bleaching, by growing on the dead skeletons of the hard corals. What gives them this advantage is unclear, but it seems to be related to their ability to resist higher temperatures better than the stony corals. One of the key pathways corals use to prevent heat stress damage is the expression of heat shock proteins in their tissues. These proteins are molecular chaperones, stabilizing, enzymes, DNA, and RNA maintaining their function at deleterious temperatures. Using Polyacrylamide gel electrophoresis (PAGE) this new study will investigate the molecular processes such as the induction of heat shock protein 20, that play an important role in the survival of Anthelia. in conditions lethal to many stony corals, allowing Anthelia and other soft corals to outcompete stony corals during reef recovery.

870. The Current State of Global Coral Reef Restoration Efforts

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Collin Cooper

Faculty Mentor: Neil Greenberg

Abstract: Being home to twenty-five percent of all biodiversity in the ocean, coral reefs are invaluable to our ocean systems. These complex ecosystems are susceptible to environmental changes, making them great indicators for overall ocean health. As our climate changes a phenomenon known as coral bleaching, caused by a rise in atmospheric temperature, has begun to negatively impact many of our oceans reefs. Coral bleaching, compounded with increases in atmospheric carbon dioxide and other impactful practices such as illegal harvesting, pollution, and destructive fishing operations, have left our reefs weak and vulnerable. Knowing the importance of Earth's reefs, many researchers have been working to discover ways to reverse this damage. Techniques from micro-fragmentation, to genetically engineering corals have been researched and attempted with variable success. While there is growing demand for coral restoration, many of these restoration projects run into trouble; coral is a fragile species and difficult to propagate, which presents challenges for the stewards of the reefs. Because of this, many coral restoration projects struggle to scale the scope of their projects to fit the needs of the ecosystem. To provide a look into the current state of global coral reef restoration efforts, this review will synthesize information from relevant scientific literature. Restoration techniques and their efficacy will be reviewed as we examine how prepared we are to protect our reefs in the wake of Earth's uncertain climatological future.

871. Effect Of Topography On The Size Of Colombian Glaciers

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Ethan Sherman

Faculty Mentor: Alice Doughty

Abstract: The size and formation of glaciers reflect past climate conditions but the effect of topography on glacier size is not fully understood. Glaciers have a clear response to climate change but this response depends on their valley topography. For example, glaciers will flow faster down steeper slopes and can be confined by narrow valleys. Thus, two glaciers with different topographies will respond differently to the same climate change. Our goal is to determine the role topography plays in the length of glaciers. The primary source of data is a digital elevation model at a 30-meter resolution from SRTM of the Sierra Nevada del Cocuy (6.4N, 72.2W) mountain range in Colombia. We used MATLAB to separate the range into seven individual valleys and created a spatial mask for each valley to compare the topography for each valley. We then created flowlines that trace the center of each valley to extract the valley slope. Our results show that the maximum elevation across the valleys ranges from 5121m to 5329m. Histograms of the elevation within each valley show peaks between 4300m and 4600m indicating an abundance of this elevational range. This distribution of elevation could act as a bench causing non-linear growth in the glaciers. We expect that when the snowline lowers below this bench the glacier will grow disproportionally longer in comparison to when it is above the bench. For example, with a snowline lowering from 4700 to 4600m, the glacier would advance a short distance, but with a snowline lowering from 4500 to 4400m, the glacier would advance much farther because of non-linear increase in area to accumulate snow This does not apply only to the glaciers studied as we predict all glaciers would follow this pattern when a bench is present.

872. Investigating Bacillus velezensis BAC03 for Controlling Soilborne Diseases of Potatoes and Improving Soil Health

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Mandana Askarizadeh

Faculty Mentor: Jianjun Hao

Abstract: Bacillus velezensis strain BAC03 is a plant growth-promoting rhizobacteria (PGPR), conferring beneficial effects on plants by a variety of mechanisms, including antimicrobial activities, deriving antimicrobial secondary metabolisms, inducing plant resistance to diseases, and direct inhibition to plant pathogens. In this study, the efficacy of BAC03 was examined through greenhouse experiments and laboratory assays, aiming to evaluate its potential as a PGPR. Results showed that BAC03 effectively inhibited Verticillium dahlia and Rhizoctonia solani and reduced Spongospora subterranean by 50% in soil treatment. In the greenhouse experiment, potato ‘Russet Burbank’ and ‘Superior’ tuber pieces were planted in potting soils that was infested with Verticillium dahlia and Spongospora subterranean, respectively. Under V. dahliae infestation, BAC03 was applied to the soil at a concentration of 107 colony-forming units (CFU)/mL at planting and after emergence. Under S. subterranean infestation, BAC03 was applied at 107 and 106 CFU/mL at planting and after emergence. The results showed that V. dahlia was reduced by 50% five weeks after planting, and an increase of 12% tuber yield. Spongospora subterranea was reduced by 40% and the plants were enhanced in fresh root weight, also soluble protein in roots, leaf area, growth speed, and plant height were increased. These findings underscore the potential of BAC03 as a valuable tool for sustainable agriculture, offering effective solutions for enhancing crop productivity and disease management.

873. Frequency and Likelihood of Glacial Lake Outburst Floods in Juneau Alaska

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Anthony Mazzola

Faculty Mentor: Karl Kreutz

Abstract: A glacial lake outburst flood is when large amounts of water are released from a glacial lake when either a moraine dam or ice dam fails. These events are sudden and catastrophic, causing severe losses of life and property for those living in surrounding areas. As these events put 15 million people at risk globally, understanding these events and their likelihood is critical for public safety and planning. To achieve this understanding, this study plans to use river data from gage stations on the Mendenhall River and the Lemon Creek River to monitor the outflow from the lemon creek and Mendenhall glaciers over the past years and see if there is an increasing frequency of outburst floods.

874. Fungal Diversity Variance in Response to Human Disturbance

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Brady Kaelin

Faculty Mentor: Peter Avis

Abstract: Our goal is to examine the impact of human foot traffic on fungal species from various locations throughout Maine. These locations were selected from sites that vary in reported foot traffic, trail maintenance disturbance, human activity, forest type, terrain, and other factors. Final sites chosen were located at parks within South Portland and at walking trails within Hirundo Wildlife Refuge. At each of the thirteen sample sites, fungal DNA was collected via soil core sampling, and then extracted in a laboratory at the University of Maine. From each site, five individual samples were taken along varying points of the trail in order to better understand the impact of heavier foot traffic on fungal diversity. Observations were taken including local mycorrhiza-compatible flora, terrain type, soil moisture, etc. Soon, DNA samples will be PCR amplified for fungal-specific genetic markers, then metabarcoded to generate a master list of fungal species recorded in each site within Maine. The purpose of this is to not only determine how foot traffic and human disturbance impacts fungal populations, but also to create a baseline of recorded fungal species in areas of Maine without any prior research in this emerging field.

875. Mass Transfer effects on Benthic Macroalgae in Central Long Island Sound

Submission Type: Exhibit

Submission Category: Natural Sciences

Author(s): Collin Beirne

Faculty Mentor: David Townsend

Abstract: Benthic coastal macroalgae communities are important ecosystem structures, providing structure and food for higher trophic levels. Nutrients diffuse into benthic macroalgae through water flow movements near the surface of the bottom, with decreasing speed closer to the bottom. A homemade instrument was used to measure the temperature, velocity, and light intensity of the water, within Long Island Sound. Scientific diving techniques were utilized to collect water samples for chlorophyll concentrations. It would seem the water velocity followed tidal movements more than it followed geostrophic currents. The chlorophyll concentrations also followed a similar trend with the flow velocity, where the highest chlorophyll concentration followed high flow regimes.

876. Development and Application of an Environmental RNA Assay for Detecting Spawning Activity in Atlantic Cod (Gadus morhua)

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Lucia Liet, Graham Sherwood, Amber Garber, Aaron Whitman

Faculty Mentor: Erin Grey

Abstract: Despite significant regulatory efforts to mitigate anthropogenic stress on Atlantic cod (Gadus morhua) in the Gulf of Maine, populations continue to face decline, underscoring the importance of protecting natural spawning sites. Traditional trawl-surveys, while informative, are spatially limited and resource-intensive. Here, we introduce an environmental RNA (eRNA) assay, leveraging reverse-transcription PCR (rt-PCR) to detect spawning activity with high specificity and minimal invasiveness. By correlating RNA signatures with observed spawning events, we identified an mRNA as an indicator for cod reproduction. This novel assay complements existing eDNA surveys, offering a more reliable method for identifying critical spawning areas and potentially informing conservation strategies.

877. The Effects of Microplastics on Coral Reefs

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Isabella Levine

Faculty Mentor: Teresa Johnson

Abstract: Coral reefs are vital in supporting diverse marine life and providing beneficial communities worldwide. Coral reefs cover less than 1% of the ocean floor which is quite a small number compared to many other marine ecosystems. Coral not only provides essential ecosystem services but also safeguards coasts, fosters ecotourism, generates biogenic amines, and serves as a nursery for many fish species. However, these delicate and fragile ecosystems face numerous threats, including climate change, overfishing, and pollution. In the past few years, the issue of MP pollution in marine environments has gained noticeable attention. Previous research has been conducted in the field to see the direct effects of pollutants. To fully understand all of the underlying problems of pollutants on coral reefs, a literature review was conducted using data from peer review articles found within the University of Maine Fogler Library Database.

New statistics have shown that there are many indirect and direct impacts on coral reef systems from the transport of these micro- plastics. Microplastics can cause a decrease in heat tolerance, new diseases, and an impact on tourism. Policies are being put in place as well as education to ensure that people understand the implications of pollutants in coral reefs. Increased exposure to marine debris can cause a depletion in coral reefs. This impact could leave to long lasting effects for humans and marine life. Coral reef degradation and microplastic pollution have raised appreciable attention to the fate of coral reef systems.

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901. SustainaVerse: A VR Experience Exploring the Impact of Climate Change through Decision-Making & Sustainability Awareness

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Hannah Milne, Ersilda Cako

Faculty Mentor: Richard Corey

Abstract: As the global climate crisis continues, innovative approaches to enhance public understanding and engagement are needed. This research project, SustainaVerse, aims to use Virtual Reality (VR) to create an immersive and interactive experience focused on climate change education. The study presents the development and evaluation of a VR game that allows users to make decisions impacting a virtual environment based on real-world climate change scenarios. Based on initial findings, VR holds promise as a powerful tool for climate change education, engaging users and prompting them to consider the consequences of their actions by educating them through engaging virtual environments.

902. Gauging Human Trust Through the Use of a Multimodal, Omnidirectional, and Immersive Autonomous Vehicle Simulator

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Adam Elkadi

Faculty Mentor: Nicholas Giudice

Abstract: As autonomous vehicles (AVs) continue to evolve and improve, a critical challenge of establishing trust between humans and these systems remains paramount. Recent studies indicate that people are negatively inclined to use autonomous systems and highlights a necessity for conducting empirical research to understand trust between humans and AVs. Using real-time trust measurements and the VEMI Lab's autonomous vehicle simulator, which creates a realistic and safe environment for passengers to interact with AVs, participants in this research were exposed to a range of common driving scenarios aimed at increasing or decreasing trust – with the goal of understanding new techniques for rebuilding trust and identifying the temporal duration required for this process. These driving scenarios included speeding, stopping at stop signs/lights, making lane changes, and swerving on the roadway. Outcomes from this project will establish a deeper understanding of human trust in AVs, uncover variables that significantly influence human-vehicle trust building, and determine which factors most improve the human-vehicle trust relationship.

903. Exploring The Impacts Of Gendered Anthropomorphized Artificial Intelligence On User Trust In Fully Autonomous Vehicles

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Rachel Coombs

Faculty Mentor: Paul Fink

Abstract: Fully autonomous vehicles (FAVs) have experienced rapid innovation and hold the potential to improve access to transportation, but are hindered by users' lack of trust in the safety of the technology. Recent studies have illustrated that increasing anthropomorphism, adding human-like qualities, of artificial intelligence (AI) interfaces can increase user trust in FAVs. One increasingly popular strategy to make FAVs more human-like is to add voice cues from an AI virtual assistant while driving. However, the current literature is unclear on how to best optimize AI voices for user trust in the driving context. To address this gap, this pilot study utilizes an immersive FAV simulator to explore three different renderings of AI voice: female, male, and androgynous/non-binary to evaluate participant trust. During the study, the FAV simulator encounters nine driving events composed of stopping at red lights, slowing down at speed bumps, and changing lanes. User trust is measured through heart rate monitoring, a modified trust investment game, and post-test questions. Heart rate is measured continuously with an increase from baseline after each event analyzed as a measure of distrust. The investment game is a behavioral measure of trust where participants bet if they think the FAV will be successful on each driving task. At the conclusion of the study the participants answer post-test questions to self-report their trust in the FAV based on the voices. Results from the physiological, behavioral, and self-reported trust scores will be used to guide the development of a future comprehensive study.

904. Communicating Resilience: Innovative Rural Municipal Digital Communication

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Adeline Stone, Elle Prescott, Dean Syed, Carter Frank, Jasmine Lopez, Emma Olney, Keeli Parker, Jessica Leahy

Faculty Mentor: Kathleen Bell

Abstract: Community resilience is essential for town governments to be able to respond to and recover from sustainability challenges. One key component of resilience is the ability of a municipality to communicate information during a challenge. However, there is very little information about how and what rural communities communicate digitally in the United States. In this study, we aimed to identify innovative or high quality examples of digital communications by Maine municipalities. We developed a digital services inventory to identify the degree to which all Maine municipal governments provide digital information, use different digital platforms, offer municipal services digitally, and provide opportunities for digital democracy. We evaluated websites of all Maine municipalities, identified examples of innovative or high quality digital communication efforts, and reflected on the trends of these innovations. Our results showed four categories of innovative digital communication: collaborative online presences, civic and community engagement platforms, digital alert systems, and AI chatbots. These findings shed light on the diverse ways in which Maine's municipalities offer services and information digitally, bolstering their community resilience. Not only does this research demonstrate the ability of some small rural towns to effectively communicate information and engage their residents, but it also provides insights into how other rural communities can improve their communication strategies to aid their populations and improve their overall resilience.

905. Fostering Community Resilience: Learning From Maine's Municipal Governments

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Ruth Griffith, Chloë Sheahan, Kaitlyn MacPhee, Kyle Pellerin, Jessica Leahy

Faculty Mentor: Kathleen Bell

Abstract: Community resilience is crucial as it enables societies to withstand, adapt to, and recover from challenges. Municipalities, especially in rural areas, can play a pivotal role in this process by providing essential services and support systems that fortify communities against sustainability challenges. Yet, relatively little is known about the role of municipal governments in fostering community resilience. In this research, we examined the provision of digital services and participation in state-funded community resilience grant programs by Maine municipal governments. Municipal digital services and grant capacities can enhance community resilience by strengthening communication, community engagement, planning, infrastructure, and services. We inventoried 484 municipal websites to assess the prevalence of 27 digital services and reviewed Maine's Community Resilience Partnership annual reports to document community action grant activity. We used mapping and statistical analyses to assess municipal digital service offerings and resilience grant activity across the state. Given the importance of ensuring equitable community resilience, we evaluated the associations between these actions, population size, and per-capita income. Our findings reveal regional variation in these actions and indicate that higher digital service levels and community resilience partnership community action grants are positively correlated with population size and per-capita income. Our results also highlight exceptions to these overall demographic associations. By documenting the actions of Maine municipalities, this work begins to uncover how digital infrastructure and services and the ability to apply for and receive community resilience grants are related to demographic factors. These findings can inform strategies to foster resilience in Maine's diverse communities.

906. The Unhoused Population's Use of Public Parks and Lands and Gear Accessibility in Maine

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Corinne Couch

Faculty Mentor: Jessica Leahy

Abstract: This poster presents two projects, a literature review titled, "The Unhoused Population's Use of Public Parks and Lands" and a Contribution Project titled, "Gear Accessibility in Maine." The unhoused population's use of public parks and lands has led government agencies astray in public park and land management. Through the literature review, I synthesize research on the perceptions of unhoused populations and public acknowledgment of unhoused individuals in public spaces. The United States is struggling with management techniques for unhoused individuals in public parks and lands, this is directly affecting the rights of unhoused individuals' use of public spaces. I document the literature that recommends education as a tool when engaging in the management of unhoused individuals in public spaces. Enhancing the education of government leaders and the general public's perception and understanding of homelessness will directly defend the unhoused populations' rights in the future. I provide recommendations for allowing public lands to be accessible and available for all.

In the second part of the poster, I present research and a project involving gear accessibility in Maine. My research results showed that access to gear libraries greatly varies throughout the state, and is dependent on an area's economic status, population density, and demand for gear. In this work, I found that many gear rental programs share similar weaknesses and strengths, especially when considering the location and accessibility of the businesses. I propose a project that demonstrates the power of gear libraries.

907. The Economic Impact of Off-Highway Vehicles

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Dalton Kelly

Faculty Mentor: Jessica Leahy

Abstract: This poster first presents a literature review on OHV recreation research and a contribution project. Off-highway vehicle (OHV) recreation has grown in popularity over the past few decades. With this increasing popularity, there are significant impacts to both state and local economies. My literature review examined the economic impact of OHV recreation on both state and local economies by looking at several statewide studies throughout the United States. I found that states have seen significantly positive economic impacts due to OHV recreation. The increase in overall OHV recreation in these states has affected not only these states in terms of total revenue, but has had notable effects on the local economies resulting. This has resulted in an increase in revenue for small businesses as well as increasing the amount of jobs. Local economies are greatly impacted by OHV recreation in the areas of transportation, lodging, gasoline, food, maintenance and repairs. As a result of these economic impacts, the rise in popularity of OHV correlates to economic growth in these states. The impact of this research is that it shows that OHV recreation can be of great benefit to the economy in regions where there are good opportunities for trails. Second, my contribution project was for the Allagash Wilderness Waterway. I worked with the Allagash Wilderness Waterway staff to install wood stoves in public camps and I also volunteered in the day-to-day operations. This project allowed me to help a park in a meaningful way.

908. Evaluating Environmental Education with Non-Readers

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Laini Frager

Faculty Mentor: Jessica Leahy

Abstract: Environmental education (EE) is the process in which individuals explore environmental issues and engage in problem solving both within their local community and across the world. Assessment of environmental education is important because it documents the impact of programming and influence on pro-environmental knowledge, attitudes and behaviors. This poster presents two components: one from my Honors thesis research, and the other from my Parks, Recreation & Tourism senior capstone course. First, I present a synthesis of literature focused on the assessment of environmental education experiences for non-readers. It is necessary to adapt evaluation tools to non-readers such as PreK youth as they are unable to use typical EE evaluation tools, such as surveys. The results from this literature review suggest several key elements that should be included in any EE lesson, missing pieces from current environmental plans, and a proposed new method of evaluation for EE lessons. Second, this poster will share the results from a Parks, Recreation & Tourism Contribution Project, during which I collected a variety of environmental education books and donated them to a first-grade classroom in Corinth, Maine. In delivering the books, I spent the afternoon with the class, reading and doing outdoor activities with the students to help emphasize the importance of environmental topics. In this poster presentation, I will share observations that emerged from this participant observation. Conversations with the teacher about learning standards, environmental science topics covered in the first-grade curriculum, and teacher preferences for environmental education aided the development of future Honors thesis-related research that will be carried out in the fall semester. Overall, both of these components set the stage for fall semester research, and the poster is ideally timed for feedback from participants.

909. Influencing Factors of Landowner Allowance for ATV Trails: A comprehensive Literature Review and Research Proposal

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Gabriella Binette

Faculty Mentor: Jessica Leahy

Abstract: In Maine, where 94% of the land is privately owned, the tourism economy thrives on access, with all-terrain vehicle (ATV) use being a key outdoor recreation activity. However, private landowners face numerous challenges in managing ATV use on their properties. This thesis will address what influences private landowner management and policy preferences to maintain or enhance ATV trails on private lands. My poster presents the first aspect – a comprehensive review of previous surveys on this subject. The next stage is shared in the poster as a proposal and will include collecting new data through a mail survey and analyzing key changes between the historical data and this newly acquired data. In the future I plan to implement a statistical model will be constructed, specifically using logistic regression, aimed at predicting the probability of a landowner permitting ATV trails on their land. This model will be informed by factors identified in the peer-reviewed literature, offering an analytical framework for understanding the dynamics that shape landowners' decisions. Finally, actionable feedback will be recommended to the nearby State of Connecticut, drawing from the findings of the research in Maine, to guide the development of policies that foster a positive experience for both ATV enthusiasts and private landowners. By shedding light on the nuanced preferences and challenges faced by landowners, this research aims to contribute valuable insights to inform the formulation of effective and mutually beneficial ATV trail management strategies in these two states.

910. Social Barriers to Recreation in the Outdoors

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Nathan Lavoy

Faculty Mentor: Jessica Leahy

Abstract: Accessibility to outdoor recreation spaces is a long-standing topic of concern which has been at the center of conversation by city planners, government officials, and parks employees who have made efforts to increase physical accessibility to countless places. Accessibility has a different meaning when viewed in a social context. Race, gender, ethnicity, and various other factors can create perceived barriers that no amount of infrastructure can reduce. In this poster, I present the social factors that have the largest effect on a person's or group of persons' decision to or not to engage physically in outdoor spaces. In a related contribution project, I sought out youth who are enthusiastic about the outdoors so that I can understand, from a youth perspective, what is attractive about spending time in outdoor spaces. I also hope my project grew their interest in the outdoors by introducing new information and possible career and interest paths. The social and physical benefits of the outdoors are such that allowing socially constructed barriers - whether real or perceived - to stand in the way of peoples' interaction with outdoor spaces is a disservice to all those who inadvertently act on false assumptions of anticipated social rejection. Many justified and real factors dissuade people from physically engaging in outdoor spaces. Through this literature review and contribution project, I identify recommendations and actions for meaningfully increasing accessibility and reducing barriers to youth participation in nature.

911. Cellulose Nanomaterials: A Novel Adjuvant and Delivery System for Aquaculture Vaccine Applications

Submission Type: Oral Presentation - 10:15 AM, Classroom B

Submission Category: Interdisciplinary Research

Author(s): Sarah Turner, Blake Turner, Kora Kukk, Jacob Holbrook, Michael Mason

Faculty Mentor: Deborah Bouchard

Abstract: This applied interdisciplinary project capitalized upon the University of Maine's research expertise, facilities, fish health , cellulose nanomaterial (CNM) science and engineering and industry partnerships in aquaculture towards the development of a new generation of CNM adjuvanted vaccines for commercial aquaculture. Disease outbreaks in aquaculture cause significant production losses, necessitating vaccines for disease management. However, vaccines can be expensive, vary in effectiveness, and produce adjuvant-induced adverse effects, causing fish welfare issues and negative economic impacts. The hypothesis was that CNM, a renewable wood fiber, could act as depots/adjuvants in vaccine formulations to achieve biocompatible, environmentally friendly, and cost-effective disease protection in Atlantic salmon, an extensively farmed finfish species. First, in vivo safety of unmodified CNM formulations was demonstrated as evidenced by minimal gross reactions in Atlantic salmon post-injection. However, indeterminate serum antibody response to CNM formulations using an indirect enzyme-linked immunosorbent assay (ELISA) suggested a need for immobilization of antigens to CNM for efficacious immunogenicity. The surface carboxyl group on TEMPO-oxidized cellulose nanofibers (TOCNF) was leveraged to investigate methods of physically crosslinking TOCN fibers into a matrix to achieve high antigen loading for controlled delivery and immunomodulation. Injectable shear-thinning TOCNF hydrogels increased IgM antibody response as determined by RT-qPCR and ELISA analysis. This could be promising with a vaccine efficacy study being the next step towards vaccine development. Improving vaccine technology for finfish aquaculture could significantly improve the sustainability of the industry in Maine, throughout the United States, and globally, as well as eventually translate to other farmed species.

912. Moving on Snowflakes and Melting Ice: Jumping, Glandular-landing and Meniscus-climbing Abilities of Snow Springtails

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Richard Viveiros

Faculty Mentor: Victor Ortega-Jimenez

Abstract: Snow springtails are enigmatic because during winter they have to endure sub-zero temperatures and move effectively on frozen soils covered with snow in order to survive. In contrast, during springtime the melting ice creates a real challenge to these animals because their tiny jumping organ (furcula) could impose limits for self-catapulting on the surface of water. However, it is uncertain how these millimeter-sized animals actually move on frozen or melting ice surfaces. We found that snow springtails are extraordinarily fast when jumping on snow. These arthropods have a rose-shaped sticky gland located at the tip of their abdomen which is inflated before launching, and subsequently used to anchor itself to the snow. On water, individuals were unable to take off and fought to climb on each other's back to jump in order to escape the watery trap that is the air-water interface. Remarkably, we discovered that these colemboleans deform the body and use their mouth and tiny furcula to exert lateral capillary forces and climb the water meniscus. Our results highlight the tradeoffs imposed by phase changes of water on the locomotion performance of these millimetric arthropods living in extreme weather. This study can help design jumping robots with the capacity to move effectively on both solid and melting ice surfaces.

913. Bioluminescence as a Sustainable Alternative for Lighting on Trails, in Parks, and Other Urban Areas

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Sam Barrett

Faculty Mentor: Jessica Leahy

Abstract: This research project focuses on the potential impacts of adopting and implementing bioluminescent plants, both natural and artificially engineered, as an alternative to modern lighting systems. I focus on how this might affect the sustainability of trails in parks and other urban areas. This literature review explores the history of bioluminescence in addition to its unorthodox applications in modern science. The concept of urban greening as a framework for sustainable land management with a concentration on outdoor lighting in urban public spaces is also presented. The philosophy as it pertains to why bioluminescence should or should not be adopted as a sustainable alternative to urban lighting is briefed upon, delving into such dilemmas as the consequences of implementing bioluminescence on visitor experience and the potential risks and benefits to the ecosystem associated with the aforementioned bioluminescent execution. These risks and benefits include both the potential effects of introducing a species to a new environment as well as the sudden constant production of light in terms of light pollution and insect attraction. The subject of bioluminescence as a sustainable lighting alternative in urban areas is further explored in an associated contribution project. First, an interpretive sign for bioluminescence as a sustainable alternative for urban lighting was displayed along with the donation of the purchase of Light.Bio's Firefly Petunias. Second, a proposal to the University of Maine to encourage the school to invest in further research of substituting bioluminescent plant species for urban lighting is included. The Firefly Petunias are acquired from the Light.Bio startup. The interpretive sign is created based on interviews with the Maine State Horticulture Team and the University of Maine Horticulture Team, with the sign itself constructed physically as best seen fit for the location it is placed to be determined as of the present. Finally, the proposal to the University of Maine was based on the information provided through interviews with each horticulture team along with the research conducted for the affiliated research project.

914. The Correlation of Best Management Practices Between Forestry as well as Parks, Recreation, and Tourism

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Liam Bradley

Faculty Mentor: Jessica Leahy

Abstract: This poster presents two distinct projects completed for the senior capstone course, "Parks, Recreation & Tourism Senior Capstone." For my contribution project, I hosted an environmental education lecture on an activity for students to gain insight on the resources trees need to survive. The activity I chose to present is called "Every Tree for Itself" from the Project Learning Tree curriculum. Students represented trees where they would need to collect resources such as water, sun, and nutrients (nitrogen/phosphorus). To prepare for this activity students cut squares of blue (water), yellow (sun), and green (nitrogen/phosphorus) construction paper to represent the necessary resources for survival. This activity demonstrates that trees require water, sun, and nutrients to survive, but too much or too little of a certain resource is unhealthy for a tree. Relatedly, my literature review focused on recommendations for maintaining important ecological resources - soil and water quality. Best management practices can be applied to both forestry and parks, recreation & tourism contexts. In forestry, BMPs are installed to mitigate risk of disturbance from non-point source pollution. In Parks, Recreation, & Tourism, stream crossings and culverts can divert water away from roads and trails to preserve linear paths and increase water connectivity.

915. Sustainable Energy Initiatives within Underserved Communities: A Review of Social Network Analyses

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Jasmine Lamb, Faizan Saif

Faculty Mentor: Sharon Klein

Abstract: Social network analysis is recognized as a valuable tool for fostering increased collaboration and understanding the relationships between actors of sustainable energy initiatives at the local level. However, a social network analysis has yet to be conducted on sustainable energy initiatives within the State of Maine. To address this gap, this study employed a systematic literature review to examine previous applications of social network analysis in the context of local sustainable energy initiatives. This article answers the following research questions through a comprehensive review of the existing literature: How has social network analysis been used to understand sustainable energy initiatives within underserved communities? Which software tools and methods for social network analysis are likely to be effective for a social network analysis conducted on actors of sustainable energy initiatives in underserved communities in the State of Maine? Based on the results, we present recommendations for a social network analysis on sustainable energy initiatives within underserved communities in Maine. We recommend the recruitment methods of purposive sampling, snowball sampling, and name generators and the data collection methods of surveys and interviews are used. For qualitative analysis, we recommend that the Atlas.ti software is used; for visualization of the network and qualitative analysis, we recommend the use of UCINET software and for the metrics of betweenness, degree, closeness, and eigenvector centrality to be analyzed (with degree centrality representing the size of nodes).

916. The Effects of Third Places on Rural Communities in Maine

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Eleanor Prescott

Faculty Mentor: Jessica Leahy

Abstract: How does social capital relate to the presence of third places in rural communities? Third places – public spaces that are not workplaces, schools or homes, have an important role in the cultivation and maintenance of a thriving society across the United States. Third places reflect community cohesion and health, and have been associated with political participation and economic well-being nationally. The relationships between the presence of third places in rural communities with social capital indicators such as civic participation, economic health, and government decision-making processes are not well understood, especially in Maine. In this research, we focused on identifying associations between third places, voter participation, unemployment rates, and form of municipal government. We collected data on these items for 50 Maine municipalities by reviewing municipal websites and accessing federal and state data resources. We used statistical methods to assess our focal correlations. Results to date suggest that the presence of third places is positively associated with voter participation and representative forms of government and negatively associated with high unemployment rates. These results offer insights to community leaders as they seek ways of fostering a sense of community, enhancing community capacity and resilience, and facilitating positive community conversations.

917. The Science of Compost: An Assessment of the Efficacy of Ungrading, Sense of Belonging, Self-Directed Learning, and Growth Mindset in an Undergraduate Research Learning Experience

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Sydney Shair, Keagan Rice

Faculty Mentor: Jennifer Newell

Abstract: Currently, traditional laboratory classes see many challenges that make it difficult to ensure learning and personal growth. An active learning technique that has gained popularity over the past decade is the use of research learning experiences (RLEs) in college laboratories. While prior RLEs have demonstrated an increase in student engagement and retention in STEM courses, none have combined an RLE with ungrading. Ungrading is a pedagogical approach that de-emphasizes grades and shifts the focus on student learning.

To that end, an undergraduate RLE class called “The Science of Compost” was created to improve students’ ability to design research and have an increase in self-directed learning, belonging, and growth mindset as a goal. This ungraded course is focused on students creating compost from food scraps from the University of Maine dining halls. The students isolate bacteria from their compost and evaluate the bacteria’s antibiotic resistance, effect on plant growth, and results from differential testing. Ultimately this guided and student-driven research project is presented at the University of Maine’s Student Symposium.

Using a pre- and post-experimental design abilities test and validated survey instruments for metacognition, self-directed learning, and sense of belonging, we expect to find an increase in each measure as a result of the course style. Using qualitative data, we report an increase in student confidence, verbal communication, community building, and learning focus. The data shows the importance of utilizing ungrading and RLEs in student learning.

918. The Role of State Networks in Advancing Community-initiated-and-engaged Sustainable Energy Action in Underserved Communities Across the United States

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Janine Siqueira Borges, Sonia Leone, Caroline Noblet

Faculty Mentor: Sharon Klein

Abstract: This study aims to understand the pivotal role of statewide Local Energy Action Networks (LEANs) in supporting and advancing renewable energy and energy efficiency (REE) in underserved communities across the United States (Klein & Noblet, 2022). Focusing on Indigenous, rural, and low-income communities, our research examines the effectiveness of LEANs in facilitating community-driven action for sustainable energy solutions through a community-engaged approach.

Building upon the framework provided by Sharon Klein and Caroline Noblet (2022), this project adopts a multi-faceted methodology. Firstly, an augmented literature review is being conducted to identify potential LEANs in each state, emphasizing their missions, actions, and engagements with underserved communities (Klein & Noblet, 2022). Secondly, in-depth analyses of target networks actively supporting REE in underserved communities will be performed by evaluating outreach methods, modes of interaction, target audience, and partnerships (Klein & Noblet, 2022).

Moreover, semi-structured interviews with leaders of these networks provide insights into the benefits, challenges, and effectiveness of LEANs in supporting REE adoption (Klein & Noblet, 2022). The interviews prioritize networks actively engaging with underserved communities, ensuring a diverse perspective across the US.

The outcomes of this research will inform hypotheses regarding the success factors of LEANs in supporting REE adoption in underserved communities (Klein & Noblet, 2022). Additionally, the study will generate a technical report, a master's thesis, and associated peer-reviewed journal articles, providing qualitative scoring of individual state LEANs' success (Klein & Noblet, 2022). Furthermore, presentations at professional conferences aim to disseminate findings and promote dialogue on fostering sustainable energy solutions in underserved communities.

By shedding light on the effectiveness of LEANs and community-driven initiatives, this research contributes to advancing equitable access to renewable energy and energy efficiency, thereby promoting environmental justice and community resilience (Klein & Noblet, 2022).

919. Reducing Loneliness for Maine's Aging Population through Social Outreach

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Kathryn Davison, Elliott Hooper, Sean Carey, Thomas Lemay, Ben Morgan

Faculty Mentor: Ali Abedi

Abstract: Social isolation has been linked to many severe health risks such as increased risk for depression, anxiety, dementia, heart disease, and a weakened immune system (National Institute on Aging, 2019). According to the U.S. Department of Health and Human Services, about 28% of older adults in the U.S. live alone, and 43% of adults aged 60 and older report being lonely (Lustig, et al., 2020; National Institute on Aging, 2019). This problem is especially concerning in Maine which is the state with the largest proportion of older individuals. With mood disorders such as depression being prevalent in older individuals, a sense of social connectedness can drastically improve one's mental health (CDC, 2023; National Institute of Mental Health, 2023). Numbers can be higher due to people not being aware of medical issues or not wanting to share information with others. To help address the issue of social isolation in older Maine residents, we plan to create a volunteer outreach program that matches available volunteers with seniors by working to identify shared traits, interests, and other connections that the individuals share. Volunteers will help seniors with household tasks such as meal preparation, chores, and pet care, as well as provide transportation services to appointments and activities outside of the home. Seniors don't want to feel patronized or that the volunteers are taking care of them. A way to circumvent this is for it to be a learning experience for all. The volunteer can learn important lessons in life from the seniors regarding interests, work, and more. Loneliness in elderly Mainers will be reduced with regular social interaction with volunteers and other seniors, which will help reduce seniors' health risks.

920. Towards Generalized Speech Separation for Hearing Aids: Deep Learning approach for combined Music and Speech

Submission Type: Poster

Submission Category: Interdisciplinary Research

Author(s): Tristan Zippert

Faculty Mentor: Terry S Yoo

Abstract: Sound plays a crucial role in our daily lives, allowing us to communicate, interact, and navigate the world. Our ability to hear, distinguish, and locate sounds is due to the complex structure of our ears and the brain's processing systems. However, hearing loss can impede our ability to communicate and socialize, leading to isolation and depression due to cognitive overload. Current Deep-learning networks designed for speech separation work well with clearly spoken voices, while Music Information Retrieval (MIR) systems parse out music into associated musical tracks. This research combines the strengths of both techniques to move toward generalized separation by exploring the outputs of both DPRNN and DEMUCs for monoaural audio. A new mixed speech music dataset was created for training, combining WHAMR with grocery store music. Metrics generated from the combined network and dataset are compared against current speech separation networks.

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1001. Early Life Broccoli Sprout Consumption Confers Stronger Protection Against Enterocolitis in an Immunological Mouse Model of Inflammatory Bowel Disease

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Lola Holcomb, Johanna Holman

Faculty Mentor: Sue Ishaq

Abstract: Inflammatory Bowel Diseases (IBD) are chronic conditions characterized by inflammation of the gastrointestinal tract that heavily burden daily life, result in surgery or other complications, and disrupt the gut microbiome. How IBD influences gut microbial ecology, especially biogeographic patterns of microbial location, and how the gut microbiota can use diet components and microbial metabolites to mediate disease, are still poorly understood. This study aimed to resolve such questions. Many studies on diet and IBD in mice use a chemically induced ulcerative colitis model, despite the availability of an immune-modulated Crohn's Disease model. Interleukin-10-knockout (IL-10-KO) mice on a C57BL/6 background, beginning at age 4 or 7 weeks, were fed either a control diet or one containing 10% (w/w) raw broccoli sprouts which was high in the sprout-sourced anti-inflammatory sulforaphane. Diets began 7 days prior to inoculation with Helicobacter hepaticus, which triggers Crohn's-like symptoms in these immune-impaired mice, and ran for two additional weeks. Key findings of this study suggest that the broccoli sprout diet increases sulforaphane concentration in plasma; decreases weight stagnation, fecal blood, and diarrhea associated with enterocolitis; and increases microbiota richness in the gut, especially in younger mice. Sprout diets resulted in some anatomically specific bacterial communities in younger mice, and reduced the prevalence and abundance of potentially pathogenic or otherwise-commensal bacteria which trigger inflammation in the IL-10 deficient mouse, for example, Escherichia coli and Helicobacter. Overall, the IL-10-KO mouse model is responsive to a raw broccoli sprout diet and represents an opportunity for more diet-host-microbiome research.

1002. A Zebrafish Model Demonstrating that DPM3 Functions in Both Dystroglycan Dependent and Independent Roles in Neuromuscular Disease Progression

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Amanda Ignacz, Claire Schaffer, Mary Astumian

Faculty Mentor: Clarissa Henry

Abstract: Skeletal muscle development, growth, and homeostasis relies on post-translational modifications, such as glycosylation. Healthy muscle function also requires the development of neuromuscular junctions (NMJs) and myotendinous junctions (MTJs), all interconnected via cell-matrix adhesion complexes that are replete with glycosylated proteins. Glycosylation is notably disrupted in dystroglycanopathies, diseases caused by disruption of dystroglycan (DG), a critical transmembrane receptor that anchors muscle cells to the extracellular matrix (ECM). An unanswered question that remains is if dystroglycanopathy genes contribute to the glycosylation of other glycosylated proteins that promote adhesion to the ECM, and what aspects of neuromusculoskeletal degeneration are specifically due to the disruption of DG glycosylation versus that of other proteins. One such dystroglycanopathy gene is dolichyl phosphate mannosyltransferase 3 (dpm3), which contributes a foundational mannose residue as a building block for the glycosylation of DG. Through our development of dpm3 and dpm3;dg double mutant zebrafish models, we have created models to elucidate what aspects of DPM3 function are DG-dependent and -independent in disease progression. While dg -/- mutants do harbor dystrophy and muscle fiber detachments, the loss of even one copy of wild-type dpm3 dramatically exacerbates NMJ, MTJ, and skeletal muscle degeneration. These findings indicate that DPM3 likely contributes to neuromuscular disease progression via both DG-dependent and DG-independent pathways, and possibly acts in a gene-dose dependent manner. Ultimately, we aim to elucidate DG-independent roles of dystroglycanopathy genes to gain fundamental knowledge for future therapeutic strategies in treating neuromuscular diseases.

1003. Investigating the Role of KRAB Zinc Finger Proteins (KZFPs) in Mitigating Non-syndromic Cleft Lip and Palate (CLP) in A/WySn Mice

Submission Type: Poster

Submission Category: Natural Sciences

Author(s): Arad Bustan, Kehinde Adeniran, Haley Fortin

Faculty Mentor: Christopher Baker

Abstract: Non-syndromic cleft lip and palate (CLP) in the A/WySn mouse strain is attributed to reduced Wnt9b expression, stemming from the insertion of an intracisternal A particle (IAP). Previous research indicates that a gene on chromosome 13 may regulate IAP activity through methylation of its 5' long terminal repeat (LTR), thereby facilitating Wnt9b expression. This chromosomal region contains a family of genes that encode KRAB zinc finger proteins, known to establish repressive heterochromatin. We hypothesized that KRAB zinc finger proteins (KZFP) on chromosome 13 play a role in mitigating CLP in mice through suppressing IAP elements and restoring normal development.

Methods: We will employee a novel method to quantify the expression of IAP levels using fluorescence-based cell sorting (termed HCR flow FISH). We will introduce KZFPs from the non-CLP strain into mouse embryonic stem cells from A/WySn mice using lentiviral transduction. HCR probes were designed to identify IAP transcripts, and flow cytometry will be utilized to collect cells with low IAP expression, suggesting they contain the KZFP repressor. mESCs will undergo RNA-seq to identify which KZFP they express to identify the modifier of CLP.

In A/WySn mice without CLP, we anticipate observing diminished levels of IAP LTR expression coupled with heightened levels of KRAB zinc finger protein expression in comparison to mice with CLP. These findings would suggest that KRAB zinc finger proteins exert a suppressive effect on IAP activity, thus permitting proper Wnt9b expression and preventing the development of CLP.

1004. Obesity and Changes in Adipose Gene Expression is Predicted by Circulating Hepatic Factors

Submission Type: Oral Presentation - 10:30 AM, Classroom B

Submission Category: Biomedical Sciences

Author(s): Madeleine Nowak, Rea Anunciado-Koza

Faculty Mentor: Robert Koza

Abstract: Heart disease and type 2 diabetes—two of the top ten causes of death in Maine—are adversely affected by obesity. In 2022, the Centers for Disease Control estimated that 30-35% of adult Mainers were obese; ergo, tackling the obesity crisis could reduce these negative health outcomes. An individual's sex and genetics along with diet and physical activity can contribute to obesity, but it is not completely understood how these factors influence each other, or why some individuals have a greater predisposition to its development than others. Resolving this uncertainty is the first step towards finding a lasting solution for the treatment of metabolic disease and obesity's comorbidities. Our research group studies how the environment and genetics interact through epigenetic mechanisms by focusing on a gene called Mesoderm specific transcript (Mest). Mest is an epigenetically regulated gene with variable levels of expression in white adipose tissue (WAT) amongst individuals. In genetically identical mice, Mest positively correlates with their susceptibility to developing diet-induced obesity. This expression is also consistent across multiple fat depots within an individual, which suggests that a systemic mechanism is involved in regulating Mest. Hepatokines—circulating factors from the liver—have been shown to correlate with WAT Mest and fat mass expansion. We hypothesized that hepatokines could predict which animals were most susceptible to obesity when they were fed a high fat diet (HFD). We tested this hypothesis using a cohort of 40 mice with blood collected before, during, and after a HFD. Our results supported this hypothesis and show that these hepatokines could be used as early predictive markers for the development of obesity.

1005. JC Polyomavirus Infection Requires β-arrestin in Primary Kidney Cells

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sophie Craig

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) infects 50-80% of the human population worldwide, establishing a lifelong, asymptomatic infection in the kidney. Under immunosuppressive conditions the virus can spread to the brain and infect the glial cells, resulting in a demyelinating neurodegenerative disease called progressive multifocal leukoencephalopathy (PML). PML is debilitating, with symptoms including motor dysfunction and cognitive impairment, and there is no cure or approved treatment. Research on the JCPyV infectious cycle is necessary to develop antivirals. Most JCPyV research has been done in immortalized cell lines, which has led to important advancements. However, immortalized cells are not the most accurate model for infection, and this work has not revealed the cell type-specific JCPyV infectious mechanisms that account for JCPyV pathogenesis in the kidney and brain. Primary cells better represent the phenotype of infected cells in vivo, and JCPyV infection must be characterized in primary kidney and brain cells to make advancements in the field. Elucidating JCPyV entry mechanisms is particularly important for targeting the earliest stages of infection. Previous work in immortalized cells showed that JC polyomavirus enters via clathrin-mediated endocytosis of the serotonin 5-HT2 receptor, a process that requires the adaptor protein β-arrestin. My research demonstrates that β-arrestin siRNA knockdown reduces JCPyV infection in primary kidney cells, suggesting that JCPyV enters primary kidney cells via clathrin-mediated endocytosis. This work begins to illuminate the mechanisms of JC polyomavirus entry in primary kidney cells, helping to uncover targets for antivirals that could reduce the spread of JCPyV and the impact of PML.

1006. Investigating the Role of Inflammatory Signaling in Adult Zebrafish Kidney Regeneration

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Olajuyin Olaleye, Heiko Schenk, William Sampson

Faculty Mentor: Iain Drummond

Abstract: Kidney dysfunction can occur due to sepsis, nephrotoxins or ischemia leading to end stage renal disease necessitating transplantation. However, organ shortages drive the need for alternative therapies. Zebrafish kidney regeneration offers promise, though mechanisms remain unclear.

Our previous study revealed similarities in the transcriptome of adult zebrafish kidney stem cells and mammalian embryonic kidney stem cells. However, zebrafish renal stem cells remain quiescent, prompting investigation into their activation mechanisms. We identified interleukin 6 signal transducing complexes (IL6st) and Ciliary Neurotrophic Factor Receptor (CNTFR) as potential mediators of zebrafish kidney stem cell communication with the microenvironment, both of which are known to be involved in cytokine signaling and Inflammation. To understand the role of these receptors in nephron regeneration, we explored the context of inflammatory response by causing sterile acute injury to the zebrafish kidney. We hypothesized that inflammatory signaling mediates stem cell activation and nephron regeneration in adult zebrafish.

We injected gentamicin nephrotoxin into zebrafish, at 4 dpi, we measured pro-inflammatory markers and observed significant upregulation. Additionally, we detected increased expression of lhx1a, wnt9b, and frzd9b, key regulators of kidney stem cell aggregation and regeneration at 7 dpi providing evidence of stem cell activation in response to inflammation. To determine if inflammatory responses alone, without injury is sufficient to stimulate stem cell activation and nephrogenesis, we administered lipopolysaccharide, an endotoxin known to induce inflammation. At 7dpi, we detected upregulation of stem cell activation markers. In conclusion, our findings highlight the crucial role of inflammatory signaling in adult zebrafish kidney regeneration.

1007. Investigating the Role of b4gat1 as a Facilitator of Axon Guidance and Muscle Development

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Kodey Silknitter, McHenna Martin, Mia Corradi, Benjamin King

Faculty Mentor: Clarissa Henry

Abstract: The dystroglycan complex is a glycosylated, transmembrane receptor that binds to extracellular proteins and is critical for muscle development. Dystroglycanopathy is a subset of muscular dystrophies in which one of the 19 proteins responsible for alpha-dystroglycan glycosylation is non-functional. A rare form of dystroglycanopathy arising from mutations in B4GAT1, an alpha-dystroglycan glycosylation gene, was first identified in 2013. Clinical presentation includes brain and eye abnormalities, congenital muscular dystrophy, and shortened lifespan. Previous studies have found that when b4gat1 is knocked-out in zebrafish, there is little to no glycosylation of alpha-dystroglycan. Additionally, when B4gat1 is truncated in mice, they display muscular dystrophy and disrupted axon guidance. Although there is a clear relationship between B4GAT1 and development of the neuromuscular system, the disruption of axon guidance on muscle health in this context has not been investigated. Preliminary data from our lab suggests that primary motor neuron axon guidance and subsequent muscle development are variably disrupted in multiple forms of dystroglycanopathy. Our current hypothesis is that b4gat1 is required for proper muscle development via aiding in motor neuron axon guidance. We have generated multiple, novel, dystroglycanopathy zebrafish models using CRISPR/Cas9, including zebrafish harboring a mutation in b4gat1. These mutants display variable muscle fiber and motor neuron damage and disruption by 1 day post fertilization. Currently, we are characterizing these mutants via immunohistochemistry staining and live time-lapse microscopy. Ultimately, these findings will offer a clearer understanding of how b4gat1's role as a necessary component of axon guidance is responsible for muscle development.

1008. Progression Predicament: Issues With Measuring Progression in Primary Open Angle Glaucoma

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Rajat Rai

Faculty Mentor: Giovanna Guidoboni

Abstract: Primary Open Angle Glaucoma (POAG), a major contributor to blindness, is recognized as a slowly progressing condition. However, consensus on its progression criteria remains elusive, leading to divergent measurement approaches by clinicians globally. Compounded by the low prevalence of POAG, conventional population-based studies face limitations, underscoring the significance of cohort studies for a more nuanced understanding. This investigation delves into an extensive dataset derived from an Indianapolis-based cohort study, leveraging Optical Coherence Tomography (OCT), often considered by ophthalmologists as the gold-standard tool for structural measurements. Despite the study's meticulous design and the adoption of cutting-edge technology, our findings reveal significant shortcomings related to both OCT measurements and the varied definitions of progression employed. Our results highlight the imperative for standardized training protocols for ophthalmologists utilizing OCT alongside the development of robust progression criteria in the context of POAG.

1009. Steamed Broccoli Sprouts Alleviate Gut Inflammation and Retain Gut Microbiota Against DSS-induced Dysbiosis.

Submission Type: Oral Presentation, 9:45 AM, Classroom B

Submission Category: Biomedical Sciences

Author(s): Johanna Holman, Lola Holcomb,

Faculty Mentor: Sue Ishaq

Abstract: Inflammatory bowel diseases are devastating conditions of the gastrointestinal tract with limited treatments, and dietary intervention may be effective, affordable, and safe for managing symptoms. Research has identified inactive compounds in broccoli sprouts that may be metabolized by the gut microbiota into key anti-inflammatories. Our research set out to identify biogeographic locations of participating microbiota and correlate that to health outcomes. We fed specific pathogen free C57BL/6 mice either a control diet or a 10% steamed broccoli sprout diet, and gave a three-cycle regimen of 2.5% dextran sulfate sodium in drinking water over 40 days to simulate ulcerative colitis. We monitored body weight, fecal characteristics and lipocalin, and sequenced bacterial communities from the contents and mucosa of the jejunum, cecum, and colon. Mice fed the broccoli sprout diet while receiving dextran sulfate sodium performed better than mice fed control diet for all disease parameters, including increased weight gain (2-way ANOVA, $p < 0.05$), lower Disease Activity Index scores (2-way ANOVA, $p < 0.001$), and higher bacterial richness (linear regression model, $p < 0.01$). Bacterial communities were assorted by gut location except in the mice receiving the control diet and colitis-inducing treatment (Beta-diversity, ANOVA, $p < 0.05$). Importantly, our results suggest that broccoli sprouts abrogated the effects of dextran sulfate sodium on the gut microbiota, that colitis erases biogeographical patterns of bacterial communities, and that the cecum is not likely to be a contributor to colonic bacteria of interest, in a mouse model of ulcerative colitis.

1010. Tissue-Clearing and Molecular Labeling of Early Axolotl Developmental Stages

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Samuel Broadbent, Marko Pende

Faculty Mentor: Prayag Murawala

Abstract: Tissue clearing has emerged as a powerful tool for whole system interrogation. Most tissue-clearing methods focus on tissue able to withstand the usual harsh chemical treatment. However, fragile tissues like embryos show deformation and damage after such approaches. Further, embryos from different animals vary greatly in their cellular composition during development. Amphibian embryos have a high-yolk cellular content which degrades during development. This is in stark contrast to most mammalian embryos where the yolk is outside a body with a high-water content. Modern tissue-clearing approaches either maintain morphology or enable isotropic sample expansion or shrinkage of water rich embryos. However, there are so far no tissue-clearing approaches for yolk-rich embryos. Here, we show a tissue clearing approach that allows all developmental stages of axolotl embryos to maintain system morphology. Further, we demonstrate the compatibility of this method with different molecular labeling approaches. Finally, we show whole embryo imaging from initial cleavage stages up to early organogenesis using light-sheet microscopy.

1011. Deciphering P. aeruginosa Mechanisms Causing Increased Drug Efficacy Against C. albicans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Trizzie Ha, Allie Conner

Faculty Mentor: Robert Wheeler

Abstract: Candida albicans and Pseudomonas aeruginosa are opportunistic pathogens that reside in similar locations in the body. Coinfections of these pathogens pose challenges to immunocompromised patients. Fluconazole (FLC) is an antifungal medication that is often prescribed to treat C. albicans infections, but recently it was found that FLC synergizes with P. aeruginosa during a coinfection with C. albicans. Bacterial supernatant – with secreted virulence factors – contributes to this synergy, but the effective dose of P. aeruginosa supernatant for synergy with FLC against C. albicans remains unknown.

To determine the effective dose of P. aeruginosa supernatant, we first prepared sterile P. aeruginosa culture supernatant from overnight cultures. Then, C. albicans was cultured with eight different doses and FLC efficacy was measured with spot assays at 24 and 48 hours of culture time to quantify fungal viability.

FLC synergizes with P. aeruginosa supernatant against C. albicans causing increased drug efficacy and fungicidal effects. This was observed at 24 hours, but was more pronounced at 48 hours across almost all doses from ratios of 1:0.05 to 1:2 (new media: P. aeruginosa supernatant). The minimum effective dose of supernatant seems to be 1:0.1 where there is some synergy at 24 hours but by 48 hours, C. albicans viable cell concentration recovers. This suggests that the effective molecule(s) in the supernatant is/are used up by 24 hours of culture. Determining the effective dose is an important step in optimizing treatment plans for polymicrobial infections and enhancing patient outcomes.

1012. Modeling Acute Kidney Injury Following Influenza Virus Infection Using Zebrafish

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Jessica Walsh, Brandy-Lee Soos

Faculty Mentor: Benjamin King

Abstract: On average, 27 million individuals become infected by influenza virus annually with 300,000 requiring hospitalization from severe infections. During the 2009 influenza A virus (IAV) pandemic, acute kidney injury (AKI) was reported in individuals with severe infections. Impaired kidney function increases the risk of developing cardiovascular diseases and can lead to kidney failure. Due to the constraints of studying AKI in humans, the zebrafish is a model organism to study AKI and research treatments. How IAV infection results in AKI and reduced kidney function is not known. To investigate potential mechanisms, we model the response to IAV infection by microinjecting IAV into zebrafish larvae where any tissue damage, including the kidney pronephros, can be monitored using in vivo confocal imaging. In developing larvae, the pronephros has two nephrons with glomeruli, tubules and ducts similar to human kidneys. We hypothesize that a hyperinflammatory response following IAV infection leads to tissue damage in the pronephros. Analysis of RNA-Seq gene expression data of the response to IAV infection in wild-type (AB) larvae revealed inflammatory response genes, including il1b, tnfa, tgfb1a and cxcl8-l1, and AKI-associated genes, such as wt1b. We compared expression of these genes in a .a zebrafish mutant with an impaired response to IAV infection due to defective neutrophil function (Tg(-8mpx:cxcr4b-EGFP)), and another mutant with an improved response to IAV infection (Spotless; mpx-/-). Understanding the expression profiles of these genes will enable us to create studies of genes that become targets of future AKI therapies.

1013. Can Zebrafish be Used to Model Human Chronic Granulomatous Disease?

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Katie Stevens

Faculty Mentor: Robert Wheeler

Abstract: Chronic Granulomatous Disease is a human genetic condition characterized by recurrent and severe bacterial and fungal infections due to deficiency in the phagocyte NADPH Oxidase complex NOX2. NOX2 is present in neutrophils and macrophages and produces toxic reactive oxygen species (ROS). In CGD patients the NOX2 complex does not produce ROS due to mutations in one of the components of the complex, most frequently the catalytic subunit gp91. The phagocytes therefore cannot effectively clear infections. NOX1 is a NADPH Oxidase complex that is structurally similar to NOX2 but is primarily expressed in epithelial cells. This means that NOX1 is abundant, and I hypothesized that it may be able to compensate for ROS production in the absence of a functioning NOX2. Pathogens infect many tissues that have both NOX2-expressing immune cells like neutrophils and macrophages and NOX1-expressing epithelial cells meaning NOX1 and NOX2 can be present in similar environments. Whether NOX1 has the potential to compensate for the loss of ROS production caused by the absence of a functioning NOX2 is unknown. In zebrafish model organism, translation of p91 can be inhibited by using a morpholino. Measuring the level of ROS present in NOX2 morphant zebrafish and comparing this to the level found in NOX1 morphants and combination NOX1/NOX2 morphant zebrafish allowed for a comparison of ROS production. Results showed varied results suggesting that these morphant zebrafish may not currently be a sufficient model for human Chronic Granulomatous Disease and NOX1 is likely not compensating for NOX2.

1014. Inferring Fosl1a Transcriptional Targets Following Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Benjamin Vetelino, Brandy Soos

Faculty Mentor: Benjamin King

Abstract: The innate immune system is crucial in the body's response against influenza A virus (IAV) infection. IAV-infected cells release cytokines that recruit immune cells to the site of infection, which causes inflammation. Zebrafish larvae are a commonly used animal model for the human immune response and recently have been used to model IAV infection. 70% of human genes have zebrafish orthologs, including important immune pathways such as the ERK/MAPK pathway. ERK/MAPK signaling leads to the regulation of hundreds of different genes that have antiviral effects. Our laboratory has profiled gene expression during IAV infection in zebrafish larvae from early (0, 6, 9 hours), early-mid (12, 21 hours), mid (24, 27 hours), and late (30, 36 hours) stages of infection using RNA sequencing (RNA-Seq). One of the genes that was upregulated with infection at all stages was the transcription factor fosl1a, an ortholog of human FOSL1, which is also known to be regulated by ERK/MAPK signaling. We hypothesize that fosl1a is responsible for the regulation of the innate immune response. After confirming fosl1a expression in IAV-infected zebrafish, we predicted Fosl1a target genes. We took a set of 2,598 human FOSL1 target genes from ENCODE ChIP-Seq studies and found 2,469 orthologs that are putative Fosl1a target genes in zebrafish. Of these, 501 were differentially expressed during IAV infection. These studies will broaden our knowledge of ERK/MAPK signaling as well as fosl1a's role in response to IAV infection which may help to yield new antiviral drug targets.

1015. Mechanisms of Cetylpyridinium Chloride Inhibition of Immune Cell Function: Unraveling CPC Effects on Tyrosine Phosphorylation Events

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sydni Plummer, Jeongwon Eom, Bright Obeng, Morgan Tasker

Faculty Mentor: Julie Gosse

Abstract: Cetylpyridinium chloride (CPC), a positively-charged antimicrobial, is used in personal care products, human food, and cleaning solutions. Yet, there is minimal published data on CPC's effects on eukaryotes. Mast cells are ubiquitous throughout the human body and are critical in immune and nervous system functioning. Previously, our lab demonstrated that CPC inhibits the primary function of mast cells, degranulation. Degranulation is when granules of bioactive compounds, such as histamine, are released from the cell when it's stimulated by an antigen (Ag). CPC inhibits degranulation by inhibiting Ag-stimulated (via IgE-bound cell surface receptors, FcεRI) store-operated calcium entry (SOCE) into the cytosol. We investigate CPC's effects on events in the cellular signaling pathway that precede SOCE to determine the mechanism of action. Using hexadecylbenzene, a chemical identical to CPC apart from its lack of positively-charged nitrogen, we show that CPC's hampering of degranulation is via electrostatic interference with signaling molecules. Results from experiments using bivalent anti-IgE antibodies, in place of the standard multivalent Ag to stimulate mast cells' FcεRI receptors, indicate that CPC does not act by interfering with the binding of Ag to IgE-bound FcεRI. Experiments are underway with Hsp70, known to stimulate mast cells in a manner that bypasses early tyrosine kinases Lyn and Syk, in order to test whether CPC affects these kinases. Another alternative stimulant, calcium ionophore, bypasses earlier steps in the cell signaling pathway, going straight to SOCE. Experiments are in progress to determine whether CPC's inhibitory effects on the cell signaling pathway lie before SOCE.

1016. Determining Essential Genes Contributing to the Regulation of the Mitochondrial Unfolded Protein Response (UPRmt)

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Seth Ashby

Faculty Mentor: Suzanne Angeli

Abstract: The mitochondrial unfolded protein response (UPRmt) is a response activated due to mitochondrial dysfunction. The Angeli lab has shown that under certain conditions, activation of the UPRmt is associated with the opening of a detrimental mitochondrial pore, which leads to lifespan shortening in the model organism Caenorhabditis elegans (Angeli et al., 2021). The Angeli lab previously performed a small molecule screen to identify novel inhibitors of the UPRmt (unpublished data). Surprisingly, this process identified that a small molecular DNA synthesis inhibitor, 5' fluoro 2' deoxyuridine (FUdR), suppressed the UPRmt in C. elegans. The mechanism of FUdR in suppressing UPRmt remains unknown. This project aims to conduct a forward genetic screen to identify mutants that can still activate the UPRmt in the presence of FUdR. To achieve this Ethyl Methanesulfonate, a mutagen, will introduce mutations into a C. elegans UPRmt GFP reporter strain that will facilitate the identification of novel mutants resistant to FUdR suppression. This project aims to screen 10,000 of C.elegans and perform whole genome sequencing to identify genetic mutants. This project has the potential to identify novel pathways of UPRmt activation, which may help us understand aging in C.elegans and humans alike.

1017. Antioxidant Effects of Yarrow Flower Extract in C. elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Allison Weymouth

Faculty Mentor: Jennifer Newell-Caito

Abstract: The flowers of the yarrow plant (Achillea millefolium) have traditionally been used by Indigenous people as an herbal medicine to treat a variety of symptoms related to inflammation, digestion, and to stop heavy bleeding (1). Polyphenols are naturally occurring plant antioxidants that act as a plant's defensive system against oxidation. In humans, epidemiological studies have shown that diets containing plants that are antioxidant rich (fruits, vegetables, legumes) have a lower risk of chronic oxidation stress-related diseases (2,3). Preliminary data show that yarrow flower extract (YFE) contains polyphenols at a concentration of 1232 +/- 162 mg gallic acid equivalents/mg of dry material. Little is known about how yarrow flower polyphenols may act as antioxidants. The goal of this project is to establish the antioxidant properties of YFE using the nematode worm, Caenorhabditis elegans (C. elegans) and the known oxidant manganese chloride (MnCl2). C. elegans has a short lifespan, provides data from a whole animal, and there are many instances of conserved modes of toxic action between worms and mammals. An LD50 curve was completed to determine the toxicity of YFE in C. elegans. The curve showed a LD10 value of 1%, a LD20 value of 10%, and a LD50 value of 58.6%. Using concentrations below the LD50 value, the antioxidant effects of YFE were measured using total reactive oxygen species (ROS), ATP quantification, quantification of advanced glycation end products, and lifespan assays all in the presence and absence of MnCl2. Quantifying the presence of ROS with and without MnCl2 showed that YFE can reduced ROS by 3-4-fold. Overall, this study demonstrates that YFE reduces oxidative stress and acts as an antioxidant in C. elegans.

References:

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2. Grosso G. Dietary Antioxidants and Prevention of Non-Communicable Diseases. Antioxidants. 2018;7(7):94. doi:10.3390/antiox7070094

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1018. The Effect of Antimicrobial Treatment on Co-infections of *Candida albicans* and Group B streptococcus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Griffin Lawrence, Kathryn Patenaude

Faculty Mentor: Melody Neely

Abstract: One of the most common causes of infant mortality is when a pregnant mother is colonized with Group B Strep (GBS) in the vaginal tract and passes the bacteria to the neonate in utero or during delivery, causing a bacterial meningitis infection. Previous data shows an increase in both virulence and growth when the fungus *Candida albicans* and GBS are co-cultured in nutrient poor media. The interactions between these commensal vaginal tract microbes results in increased resistance of GBS to clinically relevant antibiotics. Conversely, preliminary data shows no benefit to *C. albicans* survival in the presence of antifungals when grown with GBS. This project explored how interactions during a co-infection in vivo, using a zebrafish model, affect virulence outcomes when infected zebrafish were treated with clinically relevant antimicrobial treatments, such as the anti-fungal caspofungin and the antibiotic clindamycin.

1019. Construction of Zebrafish Myosin Essential Light Chain Mutants

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Mason Soares, Tayo Adekeye, Jared Austin

Faculty Mentor: Jared Talbot

Abstract: The essential light chains (ELCs) are an important part of fast-twitch muscle, helping myosin proteins cross-link with actin to form a sarcomere structure. In unpublished work, we show that Mylpf, the gene for fast-twitch regulatory light chain (RLC), is essential for the formation of sarcomeres, but the significance of ELCs remains unclear. In humans, the ELCs of fast twitch muscle are encoded by the gene MYL1, which is required to prevent severe muscle disease. The MYL1 gene produces two proteins, MYL1 and MYL3. Because MYL1 contains an N-terminal extension that MYL3 lacks, it is assumed that MYL1 is more important in linking the myosin to actin; however, this has never been experimentally tested. Zebrafish are an excellent model organism for investigating human MYL1 because in zebrafish, the two transcripts are encoded by separate genes called myl1 and mylz3, respectively. We find that the myl1 mutant shows mild defects in muscle structure. Compared to the severe human MYL1 disease, these results suggest that mylz3 may play a vital role in muscle structure. We have generated a zebrafish mosaic for a frameshift in mylz3 using CRISPR/Cas9. After outcrossing these mosaic founders, we find that a subset of the F1 generation contains frameshifting alleles. Fish containing mylz3 frameshifts have been outcrossed to established myl1 mutants and are being raised. This summer, we will analyze the mylz3 mutant alongside the myl1 mutants and myl1;mylz3 double mutants to perform the first experimental test of how the two ELC isoforms impact muscle development.

1020. Characterizing the Multi-System Impacts of crppa-Associated Dystroglycanopathy

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Mia Corradi

Faculty Mentor: Clarissa Henry

Abstract: Skeletal muscle has been the primary focus of muscular dystrophy research but fails to address the multi-system complexity between muscle and other impacted tissues. Muscular dystrophy (MD) is a group of neuromuscular diseases with varying onset and severity. One form of MD is dystroglycanopathy, which arises when α-Dystroglycan (α-DG) is hypoglycosylated due to mutations in any of the 19 associated genes. α-Dystroglycan plays a critical role in linking the actin cytoskeleton to the extracellular matrix, providing stability to muscle. One gene required for α-DG glycosylation is CRPPA. CRPPA-associated dystroglycanopathy is one of the most common forms of the disease, with patients experiencing muscle weakness, wasting, and eye and brain abnormalities. To study neuromuscular diseases, the Henry Lab has developed a novel zebrafish model that harbors a nonsense mutation in crppa, which results in non-functional protein and pathological phenotypes. While it is known that a defect in CRPPA can cause dystroglycanopathy, the downstream effects in later development and other structures are poorly understood. Based on our current understanding, it is hypothesized that crppa is involved in dorsal-ventral muscle development and can lead to abnormalities in other structures later in development. Continuous research can eventually lead to rescuing the abnormal phenotypes CRPPA mutations are associated with and expand the knowledge of neuromuscular diseases in general. Ultimately, researching the impact of crppa on development and characterizing the defects observed in dystroglycanopathy can benefit those affected by life-threatening neuromuscular diseases.

1021. NLRP3 Inflammasome Activation and the Inflammatory Response Following Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sarah MacLeod, Brandy-Lee Soos

Faculty Mentor: Benjamin King

Abstract: Influenza virus poses a continuous health threat, contributing to 16,000-48,000 deaths from October 2023 to February 2024. This virus is primarily attributed to severe respiratory infections. The most predominant type, influenza A virus (IAV), has been the cause of seasonal epidemics and four global pandemics in the past century. Although vaccines are widely administered, the diversity of IAV strains diminish their effectiveness. Inflammation is an innate immune response used to clear infections, but it needs to be carefully regulated as hyperinflammation can lead to tissue damage. Inflammasomes are activated following infection and activate inflammatory pathways, but all of the genes activated by inflammasomes are unknown. The NF-kB pathway is a prototypical proinflammatory innate immune pathway and mediator of the NLRP3 inflammasome activation and the inflammatory response. We use zebrafish as a model model of the human innate immune response to IAV infection in order to identify target genes for potential antiviral therapies. Using RNA sequencing data of eight timepoints (0, 6, 9, 12, 21, 24, 27, 30 and 36 hours post infection (hpi)) and Nanostring gene expression data at 12, 24 and 36 hpi, we identified known NF-kB target genes that were differentially expressed. At 36 hpi, 1,969 differentially expressed genes were NF-kB target genes, including interleukin 1 beta and caspase 1 that are both activated by inflammasomes. This research will aid in establishing foundational data with inflammasome activation post IAV infection leading to new potential antiviral targets; aiding in combating IAV infection.

1022. Microbial Modulation of Neuroinflammation and Amyloid-Beta Aggregation in Alzheimer's Disease through the Gut-Brain Axis: Implications for AD Patients with Gut Dysbiosis

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Saba Ho-Rezvani

Faculty Mentor: Leonard Kass

Abstract: Alzheimer's Disease (AD) stands as a multifaceted neurodegenerative disorder classically characterized by the accumulation of amyloid-beta plaques and neurofibrillary tangles in the brain, precipitating cognitive decline. While aging remains the foremost known risk factor, genetic predispositions and environmental influences play pivotal roles in disease etiology. Recent advances spotlight the gut-brain axis, illuminating its role in neuroinflammation and AD pathogenesis. This research delves into the interplay between gut microbiota, neuroinflammation, and AD progression, focusing on implications for patients with gut dysbiosis.

Dysbiosis-induced alterations in the gut microbiota destabilize intestinal barriers, fostering increased permeability and subsequent translocation of inflammatory bacterial components into systemic circulation. Recognition of these components by pattern recognition receptors on immune cells incites a cascade of proinflammatory cytokine release. Critically, these signals are relayed via the vagus nerve to the central nervous system (CNS), sparking microglial activation and neuroinflammation. This inflammatory milieu disrupts amyloid precursor protein processing, promoting beta-amyloid plaque formation, and drives aberrant tau protein phosphorylation, fostering neurofibrillary tangle formation. These hallmark pathologies culminate in synaptic dysfunction, neuronal damage, and cognitive impairment characteristic of AD. Understanding the gut-brain axis's impact on AD pathogenesis reveals new potential therapeutic avenues, including dietary modifications, probiotics, and prebiotics. Such interventions aim to restore gut microbial balance, mitigate neuroinflammation, and potentially alleviate AD pathology.

1023. Impact of Prophage-Driven Regulation of mppA on Bacterial Fitness in Group B Streptococcus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Dominic Needham, Caitlin Wiafe-Kwakye

Faculty Mentor: Melody Neely

Abstract: Streptococcus agalactiae—also known as Group B Strep (GBS)—is an opportunistic bacteria that asymptomatically colonizes about 1 in 5 pregnant women, but poses serious risks to immunocompromised populations, such as infants. Colonization of the vaginal tract can lead to infection of the baby in utero or during delivery, resulting in pneumonia, sepsis, or meningitis, contributing to around 150,000 neonatal deaths annually. While intrapartum administration of antibiotics has been successful in reducing neonatal GBS complications, antibiotics can disrupt infants' developing microbiota and contribute to rising antibiotic resistance. Novel GBS treatments are necessary to improve patient outcomes. Bacteria often carry prophage, or viral DNA integrated into the bacterium's genome, which are known to contribute to bacterial pathogenicity and fitness. The Neely lab previously showed the presence of a prophage in one GBS isolate, CNCTC 10/84, conferred an advantage in growth compared to its phage-cured version. RNA-Seq analysis showed significant differences in gene expression between the two strains, including within the opp nutrient transport system. Expression of murein peptide permease A (mppA), an opp member, was significantly decreased in the prophage-containing strain compared to the phage-cured strain. To assess the effect of gene regulation by prophage on GBS fitness, an mppA knockout of CNCTC 10/84 will be constructed and compared to the prophage-containing and phage-cured strains through analysis of growth competition and membrane permeability. Further investigation of prophage-mediated gene regulation is vital for understanding its impacts on bacterial fitness, and may lead to improved treatment methods.

1024. Analyzing Drug Targeting Effects on Cluster Patterning of Serotonin Receptors during JC Polyomavirus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Lucas Bennett, David Winski, Samuel Hess

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) is a ubiquitous human pathogen that infects 50-80% of the human population, persisting as an asymptomatic infection in the kidneys. In immunocompromised individuals, JCPyV can migrate to the brain, causing a debilitating demyelinating disease known as progressive multifocal leukoencephalopathy (PML). During infection, viruses utilize a specific subset of receptors on the cell surface to hijack normal cell processes and enter the host cell. JCPyV requires the serotonin (5-hydroxytryptamine) subtype-2 receptors (5-HT2Rs), to mediate entry and infection of host cells. JCPyV localizes with 5-HT2Rs during entry and induces receptor clustering, which likely drives viral endocytosis. The mechanism of receptor clustering and the effects of receptor interactions and cluster disruption on JCPyV infection remain unclear. We have utilized super-resolution microscopy techniques to characterize and analyze receptor cluster patterning during JCPyV attachment and entry to better understand how these receptor complexes support productive infection. Understanding how these receptors support entry during viral infection is key to defining potential cellular targets for treatments to prevent PML. Furthermore, defining how receptor clustering impacts JCPyV infection may lead to the repurposing of current FDA-approved drugs to prevent PML development through inhibition of viral entry.

1025. Using Hybridization Chain Reaction (HCR) to Investigate Migratory Muscle Formation in Zebrafish

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Angelina White

Faculty Mentor: Jared Talbot

Abstract: In order to visualize and understand a gene's function it is important to know the abundance of the mRNAs in the cell. Hybridization Chain Reactions in situ are a useful tool for visualizing specific mRNAs in an organism. This approach polymerases DNA probes at specific mRNA sites within cells, enabling high-resolution imaging of gene expression. Starting with the detection stage, the probes are hybridized and initiated in the sample. Then to the amplification stage, which uses hairpin DNA to attach to the probes and amplify them so we are able to visualize the specific mRNA in multiple different genes. This HCR method not only facilitates differentiation between cells and signaling pathways but allows us to further explore the expression patterns of muscle precursors in a zebrafish model. During this process, four sets of genes were tested, with three genes per set. One set tests myosin light chain patterns, the next shows estrogen receptor expression, and the third shows chemokine signaling, while our final set is used as a control with known expression patterns. Each of these sets allows us to examine the localization of mRNA for key components of different signaling pathways at high resolution. By applying the HCR method with our selected probes, we will gain a better understanding of muscle formation within each cell of a developing organism.

1026. The Role of Flotillin in Prophage-driven whiB7 Expression and Antibiotic Resistance in Non-tuberculous Mycobacteria

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ashley Howes, Hector Orellana, Sarah McCallister, Hilda Frempong

Faculty Mentor: Sally Molloy

Abstract: Non-tuberculous mycobacteria (NTM) infections are on the rise in North America with cystic fibrosis and immunocompromised patients the most susceptible to antibiotic-resistant Mycobacterium abscessus/chelonae infections. In 2019, mycobacteria were the seventh most-drug-resistant microorganisms and are often extensively or totally drug-resistant. Although acquired resistance mechanisms contribute to mycobacterial drug resistance, there is a large regulon of conserved mycobacterial intrinsic resistance genes that when expressed further increases resistance. RNA sequencing analysis and minimum inhibitory concentration (MIC) assays showed that the presence of prophages, integrated bacteriophage genomes, increased antibiotic resistance and the expression of whiB7, the master regulator of mycobacterial intrinsic antibiotic resistance genes. The highest expressed gene in mycobacteria carrying two prophages, BPs and McProf, was an uncharacterized flotillin gene (99-fold increase). A secreted toxin system encoded by the prophage McProf is responsible for the increased whiB7 expression and also drives the expression of the flotillin gene. Flotillins are known to play important roles in organizing toxin secretion complexes in Staphylococcus aureus and therefore we hypothesize that the mycobacterial flotillin may play an important role in mycobacterial toxin secretion and the observed whiB7 expression. In this project, we will create a flotillin deletion mutant of the M. chelonae (McProf) strain and carry out qPCR and minimum inhibitory concentration assays to determine if the presence of flotillin affects whiB7 expression and amikacin resistance.

1027. A Collaboration with the Phage Genomics Course to Isolate and Characterize Novel Bacteriophage that Infect Pathogenic Mycobacteria

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Amy Hardy, Alison Kueck

Faculty Mentor: Sally Molloy

Abstract: Non-tuberculous mycobacteria (NTM) cause pulmonary disease in cystic fibrosis patients and are often multi- or totally antibiotic-resistant. With a global rise in NTM infections and deaths, alternative treatments are necessary. Phage therapy, the use of lytic bacterial viruses, has been successfully used to treat totally drug-resistant mycobacteria. A large archive of diverse Mycobacterium phages exists but most were isolated on non-pathogenic strains and do not infect pathogenic mycobacteria. This project aims to isolate novel mycobacteriophages on pathogenic Mycobacterium that could be used for phage therapy. Eighty samples were processed for phage isolation using the bacterial host M. chelonae, which resulted in 29 plaque isolations but they could not be cultivated. As an alternative approach, we attempted to capture mycobacteriophage particles released from lysogenic strains, resulting in 3 distinct plaques that could not be cultivated. To further characterize lysogenic NTM strains, prophage genomes were annotated. prophiMCKB9-1 was identified in a strain of M. chelonae and prophiMMUKB10-1 was identified in a strain of M. mucogenicum. prophiMCKB9-1 is a cluster MabF prophage with a 51,898-bp genome, 64% GC content, and encodes 77 putative genes and one tRNA. prophiMCKB9-1 has an integration-dependent immunity system, with an integration site different from other MabF prophages. prophiMMUKB10-1 is a novel singleton prophage with a 107,468-bp genome, 65.7%GC content, and encodes 194 putative genes. The genomic organization of prophiMMUKB10-1 is consistent with Siphoviridae but has a ~12-kb region between the terminase and portal genes that consists largely of genes with unknown functions.

1028. Zebrafish Compensate for Impaired Fast-twitch Muscle Activity by Increasing Slower Movements

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Troy Hupper, Dmitrii Krivorotko, Jared Austin, Tayo Adekeye

Faculty Mentor: Jared Talbot

Abstract: Distal Arthrogryposis (DA) is a genetic disease causing congenital joint contracture in the distal limbs. Most DA mutations arise in genes that encode muscle contractile proteins, including the myosin light chain gene MYLPF. Although these mutations are known to cause DA, their direct effects on muscle structure and function remain unclear. Here, we investigate the importance of Mylpf using the model organism, Zebrafish (Danio rerio), which possesses two homologous genes. The duplicates, mylpfa and mylpfb, are similar in structure, but mylpfb transcripts are less abundant than mylpfa transcripts. The mylpfb mutant exhibits normal muscle structures, the mylpfa mutant exhibits severe fast-twitch muscle defects, and mylpfa;mylpfb double mutant completely lacks fast-twitch contractile structures. Slow-twitch muscle forms normally in these mutants. Corresponding to the loss of fast-twitch muscle, the mylpfa mutant shows a slowed escape response, due to impaired power-strokes that normally produce high-speed movement. However, when allowed to swim freely for 25 minutes we find no difference in distance traveled between wild-type and mutant fish. To our surprise, the mylpfa mutant increases the frequency of slow tail-bends, to precisely balance their loss of high-speed movement. We extended this analysis by examining mylpfb mutants, which look wild-type, and mylpfa;mylpfb double mutants, which move in a pattern identical to the mylpfa single mutant. These findings reveal that zebrafish larvae compensate for impaired fast-twitch function by increasing the activity of slow-twitch muscle. We propose that a similar compensatory mechanism could be employed in patients with DA to improve muscle function.

1029. The Role of Fatigue Regeneration in Disrupting Regeneration Mechanisms in Muscular Dystrophy

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Daniela Chavez de Paz Solis, Ahmed Almaghasilah

Faculty Mentor: Clarissa Henry

Abstract: Muscular dystrophy, a rare collection of diseases affecting 0.0036% of the global population, induces muscular atrophy and weakness. Duchenne Muscular Dystrophy is due to the dystrophin gene mutation, regulating muscle fiber integrity; this condition is uncurable, challenging to manage, and ultimately fatal. The mutation results in a limited production of dystrophin proteins, resulting in the loss of the myofiber membrane integrity in muscular tissue, culminating in drastically reduced muscle mass. While tissue regeneration is a common biological adaptation to rescue injured muscle fibers present in individuals with this condition, we sought to investigate the evident gap in our knowledge as to why our regeneration mechanisms do not absolve all muscular deterioration as the condition progresses—ultimately hypothesizing that these mechanisms become fatigued by the condition's repeated cycles of necrosis and regeneration. Eventually, the condition has the body progressively replace muscle with fibrous connective tissue and fat, leading to its characteristical clinical features. Our investigation utilized in-vivo zebrafish models with a dystrophin gene mutation (sapje line), mimicking genetically induced muscular dystrophy observed in humans. This model benefited our study due to the organism's parallel disease-causing genetics with humans, rapid reproduction, and transparent embryos. We followed the development of zebrafish embryos and performed several tests and experiments to investigate our hypothesis further. We found that the dystrophin mutant embryos show low muscular regeneration that worsens as a second injury is introduced at the exact location.

1030. Modeling the Innate Immune Response to Influenza A Virus using Computationally Inferred Transcription Factor Networks

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Eric Jestel, Jason Hart, Hanna Jordan, Emma Boudreaux, Steven Allers

Faculty Mentor: Benjamin King

Abstract: Influenza is a substantial threat to public health, causing 31 million symptomatic infections and 21,000 deaths during the 2022-2023 flu season in the United States. To combat Influenza A Virus (IAV) infection, the immune response elicits several regulatory transcription factors that cause rapid and systemic changes in gene expression, but there is insufficient information regarding specific mechanisms. We use zebrafish larvae as a model for the human innate immune response to IAV infection. To identify changes in transcription factors activated during various stages of IAV infection, temporal gene expression was analyzed via RNA sequencing at nine time points from 0 to 36 hours post infection (hpi). NetAct is a novel tool that infers networks of transcription factors and their activities from sets of differentially expressed genes and known regulatory relationships between transcription factors and target genes. Mathematical modeling is then used to infer relationships between transcription factors within the networks. Using NetAct, transcription factor networks were created for early (0, 6, 9, and 12 hpi) and late (21, 24, 27, 30 and 36 hpi) stages which were divided based on principal component analysis. Because NetAct doesn't represent zebrafish transcription factors, we converted the data to mouse homologs where the functions of transcription factors are well studied. The transcription factors Ctnnb1, Jun, Fos, Cebpa, and Sp1/SpI1 were significant transcription factors across both early and late stages of infection. Knowledge of these transcription factor networks will help prioritize specific transcription factors for functional studies in the zebrafish.

1031. Using Intravital Imaging in Zebrafish to Understand Signaling Underlying Neutrophil-mediated Immunity to C. albicans Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Nnamdi Baker

Faculty Mentor: Robert Wheeler

Abstract: Candida albicans is a commensal fungus affecting immunocompromised patients due to their impaired innate immune response which is integral in preventing lethal invasive candidiasis. Neutrophils maintain immunity by being recruited to the site of infection and clearing it through phagocytosis or production of extracellular traps. However, defects in recruitment lead to human disorders like WAS (Wiskott-Aldrich Syndrome), LAD (Leukocyte Adhesion Deficiency) or WHIM (Warts, Hypogammaglobulinemia, Infections, and Myelokathexis) which all promote increased susceptibility to recurrent infection. Although we understand the molecular defects of each disease, it is unclear how those defects translate to altered phagocyte recruitment, phagocytosis, and fungal killing. Intravital imaging of mutant neutrophils in the context of infection could shed some light into how each defect affects distinct aspects of the neutrophil's functional response. To quantify defects in neutrophil recruitment and clearance, we have monitored neutrophil recruitment in larval zebrafish during hindbrain injection of C. albicans. This route of infection models a systemic infection. Our preliminary results modeling loss of gradient sensing indicate that the CXCR2 receptor is important for immunity in this infection route, as expected. However, blockade of this receptor does not significantly diminish neutrophil recruitment to the infection site, suggesting that other functions of CXCR2 signaling are important for controlling candidemia. Future work will continue to examine these neutrophil immune pathways in control of wildtype as well as evasion-deficient strains of C. albicans. A cellular understanding of the roles of these pathways in candidiasis may lead to targeted treatments for increasing survival in immunosuppressed patients.

1032. Investigating the Role of a Calcium Regulator in Mitochondrial Stress and Lifespan of Caenorhabditis elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Timber Mattson

Faculty Mentor: Suzanne Angeli

Abstract: Heart attacks and strokes affect over a million people every year in the U.S. Current medical interventions for these conditions lead to ischemic reperfusion injury (IRI), where an influx of oxygen and calcium ($Ca2+$) after blood flow restoration can damage tissues. Mitochondria have an innate buffering mechanism to remove excess $Ca2+$ from the cytosol, but in chronic conditions such as IRI, this leads to the opening of the mitochondrial permeability transition pore (mPTP), a pathological pore that leads to loss of mitochondrial membrane permeability (MMP) and cell apoptosis in severe cases. The mPTP has been shown to accelerate aging and shorten lifespan in Caenorhabditis elegans. In this study, we will determine whether $Ca2+$ signaling directly impacts the opening of the mPTP and its effects on aging. Specifically, we will investigate the role of inositol 1,4,5-trisphosphate receptor (itr-1), which aids in the release of $Ca2+$ from the endoplasmic reticulum (ER) in C. elegans. We hypothesize that loss of itr-1 should reduce free cytosolic $Ca2+$, inhibit the formation of the mPTP, and inhibit lifespan shortening caused by the mPTP. If lifespan is restored to normal levels, we will confirm if the mPTP is blocked by using fluorescent markers for MMP. Learning more about how the mPTP is regulated by $Ca2+$ in C. elegans is relevant to learning more about aging and IRI in humans, and could help inform us about alternative treatments for heart attacks and strokes.

1033. Purification and Characterization of α-Galactosidase from Saccharomyces pastorianus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Benjamin Vetelino, Emily Ledue, Seth Ashby, Lauren Bagley, Ally Boucher, Samuel Broadbent, Sophie Childs

Faculty Mentor: Jennifer Newell-Caito

Abstract: α-Galactosidase (α-Gal) is a lysosomal enzyme necessary for degrading various sugar-modified substrates in the human body. In industry, α-Gal is utilized to break down unwanted sugars in food processing. Despite the wide variety of organisms capable of expressing α-Gal, the enzyme has been characterized from very few species.

Here, we purify and characterize α-Gal from Saccharomyces pastorianus to expand pan-organismal knowledge of the hydrolase. The novel α-Gal was characterized by various salinity, temperature, and pH conditions for optimization and stability. Growth conditions in flask culture were varied to optimize α-Gal expression. This was monitored using two absorbance-based methods: the Lowry protein determination assay, and an enzyme activity assay which uses the substrate p-nitrophenyl-α-D-galactopyranoside (pNPG). Additionally, sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) was used to analyze protein content. α-Gal was purified via ion exchange and affinity chromatography until a single band was seen by SDS-PAGE. Investigating the properties of novel genetic α-Gal variations could lead to improvements in many industrial and biomedical applications.

1034. Investigating how Interactions Between Streptococcus agalactiae and Candida albicans are Altered in Extreme pH Environments

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Chloe Bossow, Kathryn E. Patenaude

Faculty Mentor: Melody Neely

Abstract: The bacteria Streptococcus agalactiae (GBS) and fungus Candida albicans are opportunistic pathogens that can cause severe infections in immunocompromised individuals, including newborns. Both organisms are common colonizers of the vaginal tract which is a stressful environment due to its limited nutrient resources and acidic pH. Previous work in the Neely lab has shown these two pathogens can interact with one another to promote their survival in certain nutrient-limited media environments. However, there is not much known about how the interactions between these two pathogens can promote their survival when exposed to environmental pH stress. This project aims to determine if GBS and C. albicans are more effective at withstanding pH stress when cultured together compared to when they are cultured by themselves. We also aim to determine if GBS and C. albicans are better able to withstand immune challenges by macrophages (an acid-producing cell) when infected together compared to by themselves. For the in vitro work, unbuffered RPMI media as well as nutrient-rich THY media will be used to determine if the interaction between the two organisms allows them to withstand pH stress by altering the pH to promote growth. For the in vivo work, macrophages will be used to see how the interaction between the two organisms promotes their ability to withstand the acid stress produced during an immune challenge. Having a better understanding of how these two pathogens interact can help find better ways to treat GBS and C. albicans co-infections, especially in pregnant women and neonates.

1035. Uncovering Factors Involved in Bacterial-Drug Synergy Against Candida

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Allie Conner, Siham Hattab, Lindsey Stover

Faculty Mentor: Robert Wheeler

Abstract: The yeast, Candida albicans, and the bacterium, Pseudomonas aeruginosa, are opportunistic pathogens that co-colonize multiple sites within the human host, particularly in the immunocompromised lungs of Cystic Fibrosis (CF) patients and mechanically ventilated patients. CF patients co-colonized with both C. albicans and P. aeruginosa experience reduced lung function and poorer prognosis. We recently described how P. aeruginosa increases the effectiveness of the antifungal treatment Fluconazole both in vitro and during co-infection in a vertebrate zebrafish infection model. Iron starvation by P. aeruginosa is one important component of this antagonistic interaction, however, it does not account for most of the effect. Notably, we have found that this synergy influences the fungal calcineurin pathway. Specifically, it leads to a reduction in the translocation of crz1 to the nucleus, subsequently diminishing the expression of calcineurin target genes. Building upon our prior discoveries, we seek to identify P. aeruginosa mechanisms involved in this synergy. We are using a complementary candidate gene/unbiased screening strategy with a genome-wide nonredundant library of P. aeruginosa strain PA14 transposon insertion mutants. Identification of relevant bacterial pathways involved in Fluconazole-P. aeruginosa fungicidal activity will expand our knowledge of how bacteria communicate with Candida during co-colonization and infection, as well as increase effectiveness of clinical treatments.

1036. Effect of Mint Leaf on Oxidative Stress using C. elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Harjot Singh, Brooke Fifield, Samuel Caito

Faculty Mentor: Jennifer Newell

Abstract: Throughout history, various plants have been used for medicinal purposes in Indigenous culture. Antioxidants, such as polyphenols, have been found in many of these plant extracts and may help reduce the effects of neurodegenerative diseases caused by oxidative stress. The nematode worm, Caenorhabditis elegans, will be used as a model organism to determine the antioxidant effects of the polyphenols found in a mint leaf extract (MLE). The total polyphenolic content of MLE was determined to be 1379 +/- 190 gallic acid equivalents/gram of leaves. A dose-response survival curve was generated, and the LD10 and LD20 values of MLE were found to be 10% and 75%, respectively. Using a known oxidant, manganese chloride, oxidative stress was induced in wild-type N2 worms, and the antioxidant properties of MLE were assessed by examining reactive oxygen species (ROS), generation, total glutathione (GSH), worm lifespan, and ATP quantification. Total ROS was measured in the presence of MLE and manganese (II) chloride, and a three-fold decrease in the total ROS was observed. Additionally, MLE prevented the loss of glutathione in both 5mM and 50 mM Mn-treated worms. Oxidative stress is implicated in mitochondrial damage, as seen by a reduction of ATP in worms. Therefore, an ATP assay was performed to evaluate the impact of MLE on C. elegans mitochondrial function. In 5mM, both 10% and 75% MLE increased ATP concentration, a rescue of a four-fold increase. Data collected from this study suggest polyphenols found in mint leaf extract act as natural antioxidants in manganese-induced oxidative stress in worms.

1037. Antioxidant and Protective Enzyme Treatment To Enhance Fluorescence Imaging of Yeast (Saccharomyces Cerevisiae)

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Connor Crawford, Sudati Shrestha

Faculty Mentor: Joshua Kelley

Abstract: Fluorescence imaging is a very useful tool for investigation of the molecular workings of biological systems, and because of this optimizing conditions for its utilization is necessary. Although this technique is useful it has some negative effects on the systems it studies, which includes phototoxic effects in live cell imaging. The purpose of this research is to develop an effective antioxidant treatment that can mitigate phototoxicity and allow for higher quality images to be taken. To do this we image Saccharomyces Cerevisiae, the common bakers yeast, under various GFP excitation light intensities and exposure times to see when excitation light becomes phototoxic. Then we use an antioxidant treatment with components such as vitamin C, Trolox, and the enzyme catalase to mitigate that. To track phototoxicity throughout these experiments we analyze MSN2-GFP localization to the nucleus. The quantity of cells that have nuclear signals and how intense their signal is determines the dose of excitation light necessary to induce phototoxicity. In light of this we will use an antioxidant treatment to limit these effects. With a treatment to mitigate phototoxic effects of excitation light we will be able to image cells more frequently and in greater detail without disrupting biochemical processes of interest. Further developing strategies that are practical and effective for mitigating phototoxic effects in fluorescent imaging for all cell types, not just in yeast, will be of interest for future research.

1038. Effects of Bacillus cereus on Black Soldier Fly Larvae When Commensal Growth is Disrupted by Ampicillin

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Marcia Coburn, Kalini Jankee

Faculty Mentor: Edward Bernard

Abstract: In recent years research has been aimed at finding a sustainable, cost effective, alternative feed for livestock. One FDA-approved alternative, Black Soldier Fly Larvae (BSFL) has become of particular interest and popularity among agriculturalists due to the BSFL's ability to break down organic waste and take on its nutritional properties. BSFL use continues to increase in popularity as a livestock feed, however their probability to vector pathogenic bacteria, which is a critical concern to food safety, is currently unknown. One pathogenic bacterial species of importance is Bacillus cereus, known to cause gastrointestinal illness in humans. B. cereus growth can be exacerbated in waste substances colonized by BSFL. Given this information, investigation of antibiotic contamination and the impact to B. cereus populations must be addressed. A better understanding of BSFL's ability to vector pathogenic bacteria can be established by looking at BSFL's commensal bacteria when infected with B. cereus and treated with ampicillin, commonly found in soil. This experiment evaluates the growth of aerobic bacterial species and B. cereus under the following conditions, BSFL on potato substrate; potato and B. cereus; potato, larvae, and B. cereus; potato, larvae, and ampicillin; potato, larvae, B. cereus, and ampicillin; The information collected from this experiment strengthens the understanding and remediation efforts regarding potential safety risks when using BSFL to remediate food waste.

1039. The Role of Neutrophils During Influenza A Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Connor Aylesworth, Brandy-Lee Soos

Faculty Mentor: Benjamin King

Abstract: From 2022 to 2023, the Centers for Disease Control estimated that 31,000,000 individuals in the US contracted influenza viruses, and that 360,000 hospitalizations and 21,000 deaths were related to influenza virus infection. Severe infection by influenza A virus (IAV) can result in excessive inflammation that is generated by an uncontrolled innate immune response. Our research aims to characterize the scarcely-researched response of the innate human immune system to IAV to discover new targets for antiviral drug therapies, as the rate of antigenic shift and drift of IAV strains hampers vaccine effectiveness. Neutrophils are the first leukocytes to respond to IAV infection. We study both the genes, and the factors that regulate gene expression, of neutrophils to bolster understanding in the role of neutrophils in viral immune response. We analyze zebrafish (Danio rerio) larvae to model these responses as they have proven to be effective models of the innate human immune system. To characterize the activity of neutrophils, we use three lines of zebrafish: two mutants (WHIM and mir-199) and one wildtype (AB). Through the analysis of RNAseq data from these three lines of zebrafish, the role of inflammatory genes such as ifnphi1, ifnphi3, and socs3b are being characterized. With the analysis of these differentially expressed genes through RT-qPCR, the roles of neutrophils during IAV infection may be further characterized, and the development of new therapeutic targets may be fostered.

1040. Methiothepin Mesylate & Cetirizine: Potential Antiviral Treatments for JC Polyomavirus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Abby Kraemer, Amanda Sandberg

Faculty Mentor: Melissa Maginnis

Abstract: Approximately 80% of the human population is infected with JC polyomavirus (JCPyV) without even knowing. This lifelong infection in the kidneys usually goes unnoticed due to the asymptomatic nature of the virus. However, in immunocompromised individuals the infection can surge into a rapidly fatal central nervous system (CNS) disease known as progressive multifocal leukoencephalopathy (PML), which currently has no cure or treatment options available. JCPyV relies on specific host cell factors, such as the G-protein-coupled receptors (GPCRs) 5-hydroxytryptamine 2 (5-HT2) serotonin receptors, to carry out key steps of the infectious cycle, including viral entry and GPCR-mediated signaling. The goal of this project is to evaluate whether JCPyV infection can be inhibited by GPCR antagonist drugs, cetirizine and methiothepin mesylate. Cetirizine is a histamine H1 receptor antagonist that was identified as a hit in a high-throughput drug screen conducted by the Maginnis lab in an attempt to identify potential JCPyV inhibitors. Methiothepin mesylate is a serotonin receptor agonist that was not a hit in the drug screen, but has been shown to reduce infection of chikungunya virus (CHIKV). Evaluating these drugs that target pathways critical to JCPyV infection can prove to aid in the search for a cure for PML.

1041. Investigating the B4GAT1 Gene Using Zebrafish

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): McHenna Martin

Faculty Mentor: Kodey Silknitter

Abstract: Dystroglycanopathy is a type of muscular dystrophy in which dystroglycan, the protein that binds nerves and extracellular proteins to muscles, is impaired. Dystroglycanopathy results in conditions like dystrophy, hydrocephalus, Walker-Warburg syndrome, lowered life expectancy, and intellectual disability. As of now, there is no cure for dystroglycanopathy, but characterization of this disease and its impact on body systems may lead to novel treatments for dystroglycanopathy patients. In this project, the b4gat1 gene is investigated through the use of CRISPR-induced mutations in zebrafish. The b4gat1 gene is responsible for glycosylating dystroglycan, which connects nerves and extracellular proteins to the muscle; dysfunction has the potential to affect neuronal development and cause muscle damage. To first investigate this gene, a 7 base-pair deletion was introduced into the b4gat1 gene in zebrafish embryos, which caused a frameshift and significant truncation of the b4gat1 protein and caused muscle damage in the mutants. In order to analyze the phenotypes created by the b4gat1 truncation, the b4gat1 CRISPR mutants must first be established; line establishment involves various tasks such as sequencing, genotyping protocol design, primer design, and outcrossing zebrafish. This project follows the work done to create and establish the b4gat1 mutant line, which will be a model on which to do further phenotypic analysis.

1042. Effect of Prophages on Mycobacterial Intracellular Survival in Macrophages

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Katelyn Amero, Sarah McCallister, Caitlin Wiafe-Kwakye

Faculty Mentor: Sally Molloy

Abstract: Mycobacterium abscessus is an increasing global health threat, as it is often multi- or totally-drug resistant with a 45% treatment success rate. It is the most antibiotic-resistant nontuberculous mycobacteria (NTM), which are now isolated more than M. tuberculosis in the U.S. and Canada. Integrated bacteriophage genomes called prophages increase mycobacterial antibiotic resistance and virulence, as well as expression of intrinsic antibiotic resistance genes. Strains of M. chelonae, a closely related NTM, carrying two prophages called McProf and BPs have significantly increased expression of whiB7, a positive transcriptional regulator of a large regulon of intrinsic antibiotic resistance genes. The WhiB7-regulon gene eis (enhanced intracellular survival) encodes an acetyltransferase which increases aminoglycoside resistance. Eis acetyltransferases can also acetylate macrophage histones and impact their gene expression, suppressing autophagy, inflammation, and ROS production for bacterial killing. M. chelonae strains carrying prophages McProf and BPs have a 10-fold increase in eis2 expression, suggesting the bacteria will have increased survival inside host macrophages. The proposed hypothesis is that if the presence of prophages increases the expression of whiB7 and its target gene eis2, then M. chelonae strains carrying both McProf and BPs prophages will have greater survivability in macrophages than strains with one prophage (McProf or BPs) and the non-lysogen strain. Infection and survivability assays have been optimized using M. chelonae and RAW264.7 macrophages, and results show insignificant differences in mycobacterial intracellular survival after 48h. We are currently measuring whiB7 and eis2 expression in our lysogen and non-lysogen strains during macrophage infection.

1043. Characterizing Bacterial Cell Signaling that Leads to Increased whiB7 Expression and Antibiotic Resistance in Lysogenic Strains of Mycobacteria

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Winter Shymko, Sarah McCallister, Matthew Cox

Faculty Mentor: Sally Molloy

Abstract: Bacterial antibiotic resistance is a threat to global public health, causing difficult-to-treat infections with few therapeutic options. Cystic fibrosis patients are susceptible to the most antibiotic resistant Mycobacterium, Mycobacterium abscessus, whose treatment success is only 45%. The majority of M. abscessus isolates are lysogens meaning they carry one or more prophages, integrated viral genomes, that have the potential to contribute to antibiotic resistance. The Molloy lab has shown that prophages contribute to mycobacterial intrinsic antibiotic resistance and increased expression of whiB7, the master regulator of intrinsic resistance genes. Mycobacteria carrying prophage McProf have enhanced whiB7 expression in the presence of a second prophage, BPs. Populations of lysogens typically have a small subset of cells undergoing induction where the prophage has excised from the genome and undergoes lytic infection. BPs lytic gene expression during induction events in the presence of McProf drives whiB7 expression. It is not understood whether changes in whiB7 expression occurs in cells undergoing BPs induction or in adjacent cells where BPs remains a prophage. To monitor whiB7 in lysogen populations, time-lapse fluorescent microscopy is being performed on whiB7 reporter lysogens carrying McProf and a BPs fluorophage that reports lytic gene expression. We propose that lytic induction of the secondary prophage may activate McProf-encoded secreted toxins, therefore causing a signal to be sent to the non-induced population to increase whiB7 expression. By determining the mechanisms by which prophages drive drug resistance in NTM infections more effective therapies can be developed.

1044. Evaluation of Calcium Inhibitor Drugs in JC Polyomavirus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sydney Brown, Avery C.S. Bond

Faculty Mentor: Melissa Maginnis

Abstract: JC polyomavirus (JCPyV) is a virus that infects most of the population resulting in an asymptomatic infection in the kidneys. Within immunocompromised individuals, JCPyV can spread from the kidneys to the central nervous system and cause a lytic infection of the glial cells in the brain. This leads to demyelination, which results in the fatal disease progressive multifocal leukoencephalopathy (PML). JCPyV, like other viruses, relies on the host-cell machinery in order to cause infection. The Maginnis lab has shown that drugs inhibiting calcium-signaling pathways within the host cells, reduce infection of JCPyV. My research project is focused on testing calcium-inhibiting drugs, Thapsigargin and BAPTA-AM, to determine how JCPyV infection may regulate calcium signaling. This project tested whether JCPyV infection is altered when non-toxic concentrations of these calcium-specific drugs are present during infection. The outcomes of this research will further our understanding of the calcium-signaling pathways required for JCPyV infection, which could ultimately lead to the development of treatments for PML.

1045. Characterizing the Effects of Aging on Nuclear Transport in S. cerevisiae and C. elegans

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Remi Geohegan

Faculty Mentor: Joshua Kelley

Abstract: Defects in nuclear transport have been found in age- related diseases, including Alzheimer's Disease, and Fronto Temporal Dementia. However, mechanisms underlying how impaired nuclear transport lead to age-related disease progression remain unclear. The study of aging in humans is complex, therefore simpler, novel model organisms offer promising alternatives to elucidate conserved molecular mechanisms. S.cerevisiae and C. elegans are two well characterized model organisms used in aging research, however it is unknown whether these organisms acquire defects in nuclear transport with age. To quantify the rate of nuclear transport with age, plasmids expressing green fluorescent protein tagged with both nuclear localization and nuclear exit signals will be expressed in each organism that will continuously translocate into and out of the nuclear pore. The nuclear and cytoplasmic fluorescence will be quantified throughout the lifespan of each organism and assessed for changes with age. Nuclear transport occurs through the assembly of import and export complexes with molecular cargo mediated by Ran. Nuclear Ran is imported by NTF2 and Ran GEF that converts Ran to its active state within the nucleus. NTF2 expression will be reduced in both yeast and C. elegans to assess any changes to the lifespan of each organism. Additionally, RNA Seq will be conducted on a temperature sensitive Ran GEF strain of yeast at non-permissive temperatures to determine which genes are sensitive to the loss of active Ran within the nucleus. Targeted investigation of key regulators of nuclear transport will uncover novel molecular mechanisms in nuclear transport and age-related diseases.

1046. Knockout of Myeloperoxidase in Zebrafish is Associated with Differential Expression of 18 Inflammatory Genes During Influenza A Virus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Jasper Makowski, Connor Aylesworth, Daniela Chavez de Paz Solis, Ashley Geydoshek, Jason Hart, Hanna Jordan, Andrew Melanson, Keith Hutchison

Faculty Mentor: Benjamin King

Abstract: Influenza A virus (IAV) is responsible for 3-5 million severe cases annually, leading to 250,000-500,000 deaths according to the World Health Organization. The first response to IAV infection of the innate immune system is the recruitment of neutrophils to the site of injury or infection. If overstimulated, this response may result in hyperinflammation caused by damage to host tissues as well as pathogens. Zebrafish are used as a model for influenza infection in humans. They share 70% of genes and have transparent embryos allowing for visualization of immune cells and disease progression. Myeloperoxidase is a gene that encodes a protein implicated in the production of reactive oxygen species and hyperinflammation and is highly expressed in neutrophils. Zebrafish myeloperoxidase knockout (spotless) mutants have increased survival after IAV infection. RNA-seq data was analyzed from spotless and AB (wild-type) lines at 12, 24, and 36 hours post infection. The effect of eliminating myeloperoxidase expression is shown by differential gene expression in spotless and subsequent survival outcomes compared with AB. Using multiple techniques, spotless was shown to downregulate il1b at 24 hpi while it is upregulated in AB. The inflammatory response genes, rela, cxcl8b and tnfaip6, were also differentially expressed in spotless mutants. Gaining a deeper understanding of the genetic mechanisms that cause hyperinflammation and subsequent tissue damage may help in the development of new therapeutic targets to treat IAV infection.

1047. Determining the Role of Clathrin-Mediated Endocytosis in JC Polyomavirus Infection of Primary Kidney Cells

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Gabriella Giftos, Sophie Craig

Faculty Mentor: Melissa Maginnis

Abstract: Human JC polyomavirus (JCPyV) infects majority of the population causing a lifelong, asymptomatic infection in the kidneys of healthy people. However, in immunocompromised patients, JCPyV can spread to the brain resulting in the fatal disease progressive multifocal leukoencephalopathy (PML). PML is caused by the viral lytic infection of glial cells which results in lesions of the white matter in the brain. These lesions negatively impact motor function, speech, and vision leading to death. Currently there is no cure for PML, and the mechanisms for how JCPyV causes PML is poorly understood. Therefore, it is essential to study the mechanisms of JCPyV infection to determine potential treatments that can stop infection. Prior research has shown that clathrin, a cellular protein, is important for JCPyV entry in immortalized kidney and brain cells. While these experimental models have contributed to our knowledge of JCPyV infection, there has been no research to determine the role of clathrin for JCPyV infection in primary human kidney cells, a more accurate cellular model. The goal of this project is to discover if clathrin is utilized by JCPyV for infection of primary human kidney cells. To address this question, renal proximal tubule epithelial cells (RPTECs) were treated with two clathrin inhibitor drugs, chlorpromazine and Pitstop 2, and then infected with JCPyV. Infection was quantified using epifluorescence microscopy. This research can help further understanding of JCPyV infection in different cell types and help discover potential targets for drugs.

1048. The Role of Reverse Thinking in Experimental Design: an Example Using Microscopy

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Veronica Doyle, Noah Adelman, Mia Corradi, Weston Hartley, Mya Muthig

Faculty Mentor: Karissa Tilbury

Abstract: Microscopes are found in almost every lab and are frequently used but also one of the most commonly abused tools. Any modern microscope, from a stereoscope to a super-resolution microscope can produce an image and quantitative data; however producing useful images, most efficiently, is dependent on numerous variables such as the information needed, microscope settings and technique, and sample preparation. Reverse thinking is an efficient method to investigate these various variables to achieve desirable data from a quantitative microscopy experiment. It is an important step-by-step process during the experimental design phase, allowing researchers to save time and money by thinking about all steps of the experiment, from sample choice to data presentation, before wet work is conducted. Here we illustrate an example of reverse thinking, employed to design a quantitative microscopy experiment seeking to determine how a drug affects neurons in a zebrafish retina. We first posed the quantitative hypothesis that the drug decreases neuron populations and designed the ideal figure, followed by utilizing the software FIJI to obtain neuronal counts. To get the optimal image for our quantification, we compared widefield and spinning disk confocal microscopes. These tests indicated that the spinning disk confocal microscope was more suitable to answer this research question based on its ability to produce high-resolution images, facilitating image analysis. Overall, the process of reverse thinking is a powerful method that should be used for experiments requiring imaging. A step-by-step process makes it easier to prepare a complete material and methods section, important for reproducibility.

1049. Investigating the Role of Src Kinase in Activation of the Mitogen Activated Protein Kinase Pathway During JC Polyomavirus Infection

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Jasper Makowski, Lauren Cusson, Sophie Craig

Faculty Mentor: Melissa Maginnis

Abstract: Viruses pose a major threat to human health, with viral infections responsible for millions of human deaths each year. JC polyomavirus (JCPyV) establishes a persistent, lifelong infection of the kidneys in most of the human population. However, in immunocompromised individuals, the virus can rapidly mutate and spread to the brain where it causes a lytic infection of glial cells. Destruction of the glial cells eventually leads to the fatal, demyelinating disease, progressive multifocal leukoencephalopathy (PML). Activation of signals via the mitogen activated protein kinase (MAPK) pathway is essential for successful JCPyV infection. While the exact method of activation of the MAPK pathway is yet to be elucidated, Src, a non-receptor tyrosine kinase, can activate the MAPK cascade. Downstream effects of the MAPK pathway include phosphorylation of ERK, a critical component of JCPyV infection. This project investigated the role of Src in the MAPK signaling pathway during JCPyV infection by using chemical and siRNA inhibitors to target the kinase. Taken together, this research will elucidate the pathways that viruses utilize to infect human cells and provide possible options of antiviral treatments for JCPyV.

1050. ROS and the mPTP/UPRmt Nexus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Alyssa Castle, Matthew Sande

Faculty Mentor: Suzanne Angeli

Abstract: Elevated reactive oxygen species (ROS) result in mitochondrial dysfunction and occur with aging and age-related diseases. To mitigate these conditions, mitochondria allows for the influx of calcium but once overwhelmed, will form the mitochondrial permeability transition pore (mPTP), a channel formed in the inner mitochondrial membrane composed of F-ATP synthase. Sustained mPTP opening leads to the rupturing of the outer mitochondrial membrane, the initiation of cell death cascades, and the induction of the mitochondrial unfolded protein response (UPRmt). UPRmt activation canonically is associated with protective mitochondrial responses, but the initiation of the mPTP leads to the induction of a UPRmt response to exacerbate mPTP toxicity. Our long-term goal is to identify the role of ROS within the mPTP/UPRmt nexus as cellular targets to mitigate mitochondrial dysfunction cells susceptible to mPTP formation, We hypothesize decreased ROS or upregulated ROS-dependent proteins, such as glutathione or dismutase, will suppress the mPTP/UPRmt nexus. Within C. elegans intestinal cells, RNAi of ATP synthase will be utilized to induce the mPTP. Then, pharmacologic and genetic approaches will be used to suppress ROS and ROS-modulated proteins. We aim to influence ROS concentrations through antioxidant addition, such as NAC, Trolox, and Vitamin C. We aim to achieve genetic modifications via overexpression vectors ROS/redox regulated proteins. ROS-induced UPRmt activation will be measured using a promoter specific GFP fluorescent reporter. We expect that the addition of antioxidants or upregulation of proteins involved in ROS regulation will result in a decreased UPRmt response, as measured by GFP fluorescence.

1051. Characterization of the Yeast Saccharomyces pastorianus Digestive Enzyme α-Galactosidase

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Emily Ledue, Benjamin S. Vetelino, Emma Boudreaux, Gavin Bressette, Sydney Brown, Meg Caron, Eleanor Carrolton, Marcia Coburn, Connor Crawford, Bayarjavkhlan Ganbaatar, Trizzie Ha, Ian Harden, Amy Hardy, Kristina Kelly, Sam Kovacs, Hannah Lembree, McHenna Martin, Leah Mastrianno, Dominic Needham, Alexander Russell, Matt Sande, Annika Savage, Katie Stevens, Jessica Walsh

Faculty Mentor: Jennifer Newell-Caito

Abstract: α–Galactosidase (α-Gal) is a lysosomal enzyme that catalyzes the cleavage of terminal α-galactose residues from polysaccharides, glycolipids, and glycoproteins. Defects of α-Gal result in the development of Fabry disease, an X-linked genetic disorder that affects 1 in 40,000 males, typically resulting in premature death at 40-60 years. Fabry disease is currently only treatable with enzyme replacement therapy which is financially costly and involves severe side effects. Characterizing novel genetic varieties of α-Gal helps researchers to both further study Fabry disease and develop improved therapies using recombinant expression.

In this study, α-Gal was expressed from Saccharomyces pastorianus. Enzyme activity was measured colorimetrically to investigate the effects of several inhibitors, metals, and toxins. Gene expression of the novel α-Gal was mapped out and compared to various orthologs, including human α-Gal, using bioinformatics tools. Finally, an experimental expression vector is proposed for improved therapeutic exploration. Results show S. pastorianus derived α-Gal is suitable for biomedical applications.

1052. Identification of Candidate Antiviral Drug Targets by Compiling Genetic Screening Data for Influenza Viral Entry and Replication

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ben Curtis

Faculty Mentor: Benjamin King

Abstract: Influenza virus causes severe respiratory infection and inflammation, and causes an estimated 9-41 million illnesses in the US in 2022. Although influenza vaccines are widely used, they are not always effective due to strain variation. Antiviral drugs like Oseltamivir and Zanamivir can be effective, but recent studies have discovered drug-resistant influenza strains. Therefore, there is an urgent need for novel treatments for influenza infection. Genetic screens have been used to identify genes that are required for influenza A virus (IAV) infection and replication. The goal of our research is to discover genes that might serve as novel drug targets. We compiled lists of genes found in influenza genetic screens that were ranked by the extent virus infection/replication was altered. We then ordered the genes by rank product to find genes that had the largest influence on infection/replication in multiple studies. Next, we found zebrafish orthologs of these human genes, and compared these to gene expression data we have generated using a zebrafish model of IAV infection. We found 22 of the zebrafish orthologs to be differentially expressed at 36 hours post infection. Two of these genes, suppressor of cytokine signaling 3a (socs3a) and 3b (socs3b), regulate inflammation. We are assaying the expression of these and other candidate genes by RT-qPCR in wild-type as well as mutant zebrafish strains that have both improved and impaired responses to IAV infection. Our preliminary results suggest that this method used for gathering genes of interest has merit, and further study is warranted.

1053. Characterization of Periactive Zone Proteins at Neuronal Synapses

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Ian Harden

Faculty Mentor: Zhao Xuan

Abstract: Defective synaptic transmission is a major contributing factor to many neurological and neurodevelopmental diseases, such as Alzheimer's Disease (AD). In attempting to develop novel approaches to treating these diseases, understanding the structures and proteins related to synaptic development and function is essential. Within the synapse is the presynaptic site, containing the active and periactive zones, at which synaptic vesicles containing neurotransmitters are released. The active zone's primary role is mediating neurotransmitter release via exocytosis, and the periactive zone sorts and recycles synaptic vesicles via endocytosis. However, how periactive zone proteins localize to the presynapse and how they interact with the active zone proteins to support synaptic transmission are poorly understood. I perform two sets of experiments in the nematode Caenorhabditis elegans (C. elegans) to characterize periactive zone proteins regarding their subcellular localization and function. First, I examine whether the synaptic localization of periactive zone proteins requires kinesin-1 by comparing a periactive zone marker (APT-4::GFP) in wild-type animals and in unc-116/KIF5/kinesin-1 mutants. Second, I determine the interaction between active zone and periactive zone proteins in supporting synaptic transmission by performing behavioral assays on mutants for active zone and periactive zone genes. From these findings, further research on active-periactive zone interactions can be done to better understand their connections to synaptic transmission and thereby synaptic defects implicated in certain neurological diseases.

1054. Why Oh Why WhiB7? Characterizing Prophage-encoded ESX-secreted Toxin Systems and Their Role in whiB7 Expression and Mycobacterial Drug Resistance

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Eleanor Carrolton, Hector Orellana, Anna Schumann, Keith Hutchison

Faculty Mentor: Sally Molloy

Abstract: Nontuberculous mycobacteria (NTM), such as Mycobacterium abscessus, cause severe, multi- or totally-drug resistant pulmonary and soft tissue infections with low treatment success rates (1). Mycobacteria within the M. abscessus-M.chelonae complex (Mab-chel) naturally encode genes that increase intrinsic drug resistance (2, 3) when expressed. Expression of mycobacterial drug resistance genes is regulated by the WhiB7 transcriptional factor. There are three known drivers of whiB7 expression including certain integrated bacterial viral genomes (prophage) (3). Most clinical strains of Mab-chel carry one or more prophages (2) that commonly encode phage-encoded ESX-secreted toxin (PEST) systems. PEST systems include a WXG100 protein, a large polymorphic toxin with an N-terminal WXG100 domain and C-terminal toxin domain, and an immunity protein (4,5,6). The Molloy lab has found prophage McProf's WXG100 protein (gp99) upregulates whiB7, increasing drug resistance to amikacin, one of two drugs used to treat NTM infections. Homologs of the McProf WXG100 protein are common in Mab-chel prophages (2, 6). Some are nearly identical in sequence whereas others differ in sequence at the C-terminal end. It is unknown if related WXG100 proteins also increase whiB7 expression and amikacin resistance. To determine if homologs encoded by other prophages also affect whiB7 expression and amikacin resistance, homologous WXG100 genes and their cognate PEST systems were identified and cloned from three novel prophage genomes. Recombinant mycobacterial strains that encode each novel WXG100 protein or PEST system will be constructed and tested for amikacin resistance and whiB7 expression.

1055. Elucidating the Autophagic Machinery which Desensitizes the Saccharomyces cerevisiae Mating GPCR Ste2

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Toby Dunne, Nick Leclerc

Faculty Mentor: Joshua Kelley

Abstract: G-protein coupled receptors (GPCRs) are a crucial class of proteins for human physiology. Mechanisms that desensitize GPCRs to their ligands are essential, as prolonged receptor activation is associated with diverse pathologies from cancer to neurodegenerative disease and diabetes. In yeast, several desensitization mechanisms attenuate the signaling of Ste2, a GPCR that promotes mating competency in response to mating pheromone. Our data suggest that autophagy, a set of stress-responsive pathways that promote cell survival, may also facilitate Ste2 desensitization. Further investigation of autophagy's role in GPCR signal attenuation is warranted considering the relevance of receptors in human pathology. Here, a series of experiments designed to clarify the autophagic mechanisms controlling Ste2 signaling in yeast was performed. Genes known to participate in bulk autophagy, mitophagy, pexophagy, ER-phagy, ubiquitin dependent autophagy and cytoplasm to vacuole trafficking (CVT) pathways were deleted in cells with a fluorescently tagged receptor. If any of the cells failed to internalize Ste2 with the introduction of pheromone, the gene that was deleted must be implicated in autophagy dependent Ste2 regulation. Knowing which pathways the implicated genes function in, we could then look to find more effectors of GPCR internalization.

1056. Mechanisms of Mitochondrial Toxicity by Antimicrobial Agent Cetylpyridinium Chloride

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sophie Trafton, Emily L. Ledue, Bright Obeng, Tetiana Systuk

Faculty Mentor: Julie Gosse

Abstract: Cetylpyridinium chloride (CPC) is a positively-charged quaternary ammonium antimicrobial found at high doses in many personal care products, pharmaceutical preservatives, and agricultural products. CPC effects on eukaryotes are generally unknown, but our lab recently published data showing that CPC is a mitochondrial toxicant as potent as canonical mitotoxicants which inhibits ATP synthesis, mitochondrial $Ca2+$ levels, oxygen consumption rate, and nanoscale mitochondrial structure. The aim of our research is to deduce the underlying mechanism of mitotoxicity with focus on the tricarboxylic acid cycle (TCA) and the electron transport chain (ETC). We will also assess CPC's effect on cytosolic metabolism to investigate if other forms of cellular metabolism are inhibited. Starting at low, relevant concentrations (0.5 μM), CPC significantly inhibits electron flow from several TCA cycle intermediates. Results indicate that, while CPC does not thwart electron flow through ETC Complex I, CPC does inhibit either malate dehydrogenase activity or electron flow through succinate dehydrogenase (Complex II). We have designed an in vitro assay with mitochondrial malate dehydrogenase, which will be utilized to test whether CPC directly inhibits this enzyme by comparing uninhibited kinetic parameters (K_m = 7.43 mM, V_{max}= 0.0515 mM/min). A study on the effects of CPC on glycolysis is underway. We aim to corroborate our findings in LAD2 human mast cells to verify that the results are translatable to human cell lines that could mimic human environmental exposure to CPC. The implications of mitochondrial toxicity in disease and in the wide-spread use of CPC emphasize the significance of our work.

1057. Novel Mycobacterial Prophage Genomes and their AttB and PEST Systems: The Interest in Attachment Sites

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Alison Kueck, Eleanor Carrolton, Amy Hardy

Faculty Mentor: Sally Molloy

Abstract: Non-tuberculous mycobacteria (NTM) are ubiquitous organisms that cause pulmonary disease in cystic fibrosis patients and are often highly multidrug and antibiotic-resistant. Most NTM strains, including Mycobacterium abscessus and M. chelonae, carry prophage in the bacterial genome that are hypothesized to contribute to bacterial virulence. Whole genome sequencing was performed on genomes of four M. chelonae and M. salmoniphilum isolates from diseased fish. Thirteen novel prophages were identified, sorted into Mab clusters based on shared gene content, and characterized to understand how prophages impact bacterial virulence. The prophage genomes, defined by attachment sites (attL and attR), are 34,502-107,468 bp in length and encode 65-197 genes. Two of the prophages, prophiMSKB2-3 and prophiMSKB2-4, are in tandem in the M. salmoniphilum genome, sharing an attachment site. Integration sites in the bacterial genome were analyzed to determine how prophage integration may impact bacterial and phage gene expression. Prophage genes that are likely expressed during lysogeny and potentially contribute to virulence were identified and include toxin and antitoxin systems and Phage-encoded ESX-secreted toxin (PEST) toxin systems. PEST systems were identified in seven of the prophages, which include a WXG100 protein, a large polymorphic toxin with an N-terminal WXG100 domain and C-terminal toxin domain, and a cognate immunity protein. The Molloy lab has previously shown that prophage-encoded PEST genes affect expression of important mycobacterial antibiotic resistance genes. The PEST systems in these novel prophages will be cloned and tested for their effect on mycobacteria's drug resistance.

1058. NSP4 variants and Viroporin Function in Rotavirus

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Hayden Kittell, Lori Banks

Faculty Mentor: William Otto

Abstract: The goal of this study is to test the ion-conductance and multimerization capabilities of NSP4, the protein that is linked to pathogenesis and replication of rotavirus, from different clinical strains of rotavirus. NSP4 needs to multimerize in order to conduct calcium ion channels, which is necessary to cause the symptoms associated with rotavirus gastroenteritis. To test conductance function of these protein variants, we expressed the proteins in E. coli by transforming in plasmid encoding the different sequences of NSP4. We then detergent-extracted and purified one of the variants from the MX04 strain, utilizing the His6X-tag attraction to Ni2+-charged resin. These protein samples were analyzed for extraction efficiency and purity by Coomassie staining of SDS-PAGE gels and Western blot analysis. We observed that NSP4 primarily exists as a monomer, with dimer being prevalent in later extractions but mostly exists in the monomer form following normal SDS-PAGE. To assess the multimeric state of these proteins in bacterial membranes, we treated NSP4-containing E. coli membranes with a chemical crosslinker to stabilize multimers without detergent present. In the presence of crosslinker BMOE, each sequence of NSP4 (SA11, MXO4, MXO5, MWO13, ALN60, ALN79) showed a multimerization pattern similar to lab strain SA11, except MX05. As well, when treated with DMSO only, MX05 stayed mostly at the dimer band with the monomer being less abundant. These data show that these NSP4 sequences are able to multimerize in membranes from bacterial culture, even with a range of viroporin activity.

1059. Biomechanical Modeling of Urethral Function: Integrating Biophysics and Mathematical Modeling Techniques to Understand the Lower Urinary Tract

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Caleb Hendrick, Mohamed Zaid

Faculty Mentor: Giovanna Guidoboni, Zachary Danziger

Abstract: Mathematical modeling is utilized in various areas of physiology as a complementary approach to experimental and clinical studies to understand complex organ functions in poorly understood systems. Our work has focused on the lower urinary (LUT) cuntion, where mathematical modeling has been applied to three main LUT components, namely bladder, urethra, and neural control, with emphasis on their connection. Here, we focus on a particular aspect of the LUT function, namely filling-voiding cycles. We use mathematical modeling as a virtual laboratory to compare the effects of incorporating nonlinear LUT biomechanics, accounting for wall collapsibility and compliance, on filling and voiding cycles. Our aim is to model the trigger of spontaneous filling and voiding cycles, leading to understand the mechanisms responsible for LUT dysfunction. The model is tested against experimental data acquired from rat models. This study aims to help advance the current understanding of the LUT system and may be instrumental in improving therapeutic approaches to LUT dysfunction.

1060. Visco Elastic Properties from Unmodified to Extremely Modified Cellulose Hydrogels

Submission Type: Poster

Submission Category: Biomedical Sciences

Author(s): Sairah Damboise, Jacob Holbrook, Blake Turner

Faculty Mentor: Michael Mason

Abstract: The importance of implementing new methods of vaccination in aquaculture production is crucial as susceptibility to disease is high. Antigen-encapsulated cellulose hydrogels are a potential method for effective vaccination due to their affordability and biocompatibility. Cellulose hydrogels are formed through cross-linking, a simple modification that can be easily tuned for ideal characteristics. Modification of cellulose hydrogels is vital, as it directly affects the diffusion of the antigen into the patient as well as the shear rate of injection through a needle. Cellulose hydrogels were formulated from unmodified to extremely modified and with different salt formulations encompassing shear thinning characteristics. These hydrogels were tested using a rheometer and a slump test, measuring how dense a fluid flows due to an applied force, otherwise known as its shear thinning. Results from testing determined the most effective modification of the cellulose hydrogel for vaccination delivery.

The Center for Undergraduate Research (CUGR) at the University of Maine facilitates faculty-mentored research, scholarship and creative activities for undergraduate students across all academic disciplines. The office provides funding, on a competitive basis, to eligible students every academic year and summer term.

CUGR, in partnership with the Maine Space Grant Consortium, also offers funding to graduate students whose work is focused in aerospace technology, space science, Earth science, and human exploration/space development, and other science or engineering-related fields.

Additionally, the CUGR office organizes the UMaine Student Symposium, an annual event occurring every Spring, which gives undergraduate and graduate students from across all disciplines at UMaine and UMaine Machias the opportunity to showcase their research and creative activity to the UMaine community and beyond.

We hope you'll join us for the next UMaine Student Symposium, on April 11th, 2025!