THE UNIVERSITY OF WINNIPEG

15th Virtual Randy Kobes UNDERGRADUATE RESEARCH SYMPOSIUM

September 2020

The 15th Randy Kobes Undergraduate Research Symposium displays some of the excellent quality research by undergraduate students at the University of Winnipeg. This event is a valuable opportunity for students to obtain experience in presentations of scientific research, especially because much of the research presented will ultimately be published in leading scientific journals.

September 14-18 – ZOOM PRESENTATIONS

September 21-25 – JUDGES REVIEW

September 30 – AWARDS CEREMONY
Via Zoom @ 12:30pm

PROGRAM:

Welcome from the University of Winnipeg:
Dr. Doug Goltz, Dean of Science

A Few Words:
Gabor Kunstatter

Acknowledgments:
Dr. Doug Goltz, Dean of Science

Presentation of Awards:
Dr. Doug Goltz, Dean of Science
Dr. Jino Distasio, VP Research & Innovation

The poster contest has been named in memory of Professor Randy Kobes, Associate Dean of Science and Professor of Physics. Dr. Kobes' untimely death on September 18, 2010 represents a great loss to the University of Winnipeg and to the world of science. A co-founder of the annual poster contest, Dr. Kobes was committed to research, especially with undergraduate students.

GUEST JUDGES:

We'd like to thank the following people for choosing the award recipients:

Kerrie Hayes – Director Contracts, Office of Research Services, University of Manitoba

Yvette Shang – Business Development Specialist, Mitacs

Jennifer Cleary – Manager, Programs, Research Manitoba

Peter Siemens – Retired Businessman, currently serves on the Board of various International Health Care Companies

Janice Reyes Bain – Operational Support Assistant, Library Administration, University of Winnipeg

Murray Alexander – Adjunct Professor, Dept. of Physics, University of Winnipeg

Alfonz Koncan – A.Koncan & Associates Ltd.

Rebecca Danos – Celebrated Physicist & Author

Lianne Fontaine – UWinnipeg Alumni & Daughter of Randy Kobes

Elliot King – Research Partnerships Promotion Officer, Prairies Regional Office, NSERC

Sandy Tolman – Administrative Assistant, Dept. of History, University of Winnipeg

Lara Arnason – Program Officer, Research Development, VP Research & Innovation, University of Winnipeg

SPONSORS:

We gratefully acknowledge sponsorship from:

The University of Winnipeg Dean of Science Office

THE UNIVERSITY OF WINNIPEG
THE FACULTY OF SCIENCE

1. **Presenters: Catherine Goltz**
"The Impacts of Nitrogen on Cyanobacterial Harmful Algal Blooms in Eutrophic Water Bodies"

Supervisor: Dr. Nora Casson
Department: Geography
Category: Biological Sciences

Abstract: Cyanobacterial blooms can occur naturally, however have worsened over recent years due to anthropogenic influences, increasing nutrient loading and climate change. Though cyanobacterial blooms rely on the influx of phosphorus into waterbodies, research suggests inorganic and organic forms of nitrogen play a role in the production of toxins within these blooms. The goal of this project is to understand how different forms of nitrogen (nitrate, ammonium and urea) influence the growth of algae and production of microcystin in small urban lakes. The results of this study demonstrate that differing forms of nitrogen influence algal biomass, while site plays a role in differing microcystin presence. These results will improve our understanding of the role nutrients play in toxin release enabling effective management of nutrient runoff.

2. **Presenters: Karl Friesen-Hughes**
"Seasonal patterns of stream nitrogen and nitrogen:phosphorus stoichiometry in cold region agricultural streams"

Supervisor: Dr. Nora Casson
Department: Biology
Category: Biological Sciences

Abstract: Cold, agricultural regions are getting warmer and experiencing shifts in precipitation patterns resulting in reduced snowpack and higher annual proportions of summer rainfall, which affects nutrient dynamics. Previous work has demonstrated that phosphorus concentrations are regionally coherent in streams of the northern Great Plains, suggesting a climatic driver. Stream nitrogen patterns in this region are poorly understood, despite the importance to water quality. Using data from three southern Manitoba agricultural streams, this research aims to investigate patterns and drivers of nitrogen concentrations and to connect these to climate change.

3. **Presenters: Aliana Fristensky**
"Carbon pools and fluxes in a central Ontario forested ecosystem"

Supervisor: Dr. Nora Casson
Department: Environmental Studies & Sciences
Category: Biological Sciences

Abstract: In our changing global climate, it is increasingly important to understand the role of forests in the carbon cycle. This research aims to identify and compare the magnitudes of carbon pools and fluxes within the Turkey Lakes Watershed (TLW), a forested experimental watershed in central Ontario. Research pertaining to carbon pools and fluxes in the TLW were identified within a larger compendium of research for the watershed and carbon data was extracted and compiled into a database. Interpreting this data will help us to better understand carbon dynamics at TLW and will contribute to further research comparing carbon cycling across other long-term ecological research (LTER) sites.

4. **Presenters: Lucas Mosienko**
"The impact of nuisance mosquito control on bat activity and feeding behaviour in the City of Winnipeg"

Supervisor: Dr. Craig Willis
Department: Biology
Category: Biological Sciences

Abstract: Cities can be difficult environments for wildlife, but some bat species have adapted to urban environments. Winnipeg is unusual among North American cities in its historical and continuing use of broad-spectrum insecticides to manage nuisance mosquitos and this could affect insect-eating wildlife. We will test the hypothesis that Winnipeg's mosquito control program affects activity and foraging behaviour of bats. We will use acoustic detectors to record communication and feeding calls of bats throughout Winnipeg, before and after mosquito fogging events, and use insect traps to quantify food availability. This study represents the first survey of the bat community in Winnipeg.

5. **Presenters: Haven Soto**
"Do pre-hibernation fat reserves explain the persistence of little brown bats (Myotis lucifugus) after white-nose syndrome invasion"

Supervisor: Dr. Craig Willis
Department: Biology
Category: Biological Sciences

Abstract: Bats affected with white-nose syndrome (WNS) use energy reserves too quickly during hibernation, causing population declines, but post-WNS bats from some persisting populations have larger pre-hibernation fat reserves compared to pre-WNS individuals. We used a northern population of Myotis lucifugus to test whether: 1) pre-hibernation fat reserves explain persistence of post-WNS bats; and 2) post-WNS bats increase food intake before hibernation resulting in fat accumulation. We measured body mass (n = 112) and quantified plasma triglycerides (n = 32), and compared values to those previously reported from before WNS invasion. We found no effect of WNS on body mass or plasma triglyceride concentrations, which suggests other mechanisms explain the persistence of our study population.

Soto, H.S.J.S[1], Muise, K.A.[1], Fletcher, Q.E.[1], Dzal, Y.A.[1], Shrivastav, A.[1] and Willis, C.K.R.[1] [1] *Department of Biology, University of Winnipeg, Winnipeg, MB*

6. **Presenters: Grace Sidhu**
"Using the gallbladder as a novel biomarker for stress in wildlife"

Supervisor: Dr. Caleb Hasler
Department: Biology
Category: Biological Sciences

Abstract: The effects of stressors on organisms have been well-studied. The gallbladder, however, has not been extensively studied as a stress biomarker in wildlife. I compiled relevant studies to see if gallbladder tissue would be useful for understanding stress in wildlife. In total, 135 papers were found and many focused on fish, and exposure to polycyclic aromatic hydrocarbons. Stressors did affect the appearance and composition of the gallbladder and bile it stores. It was found that the gallbladder could be an effective biomarker for stress.

7. **Presenters: Erin Hare**
"Repeatability of Swimming Performance in Small-bodied & Juvenile Freshwater Fish: A Review"

Supervisor: Dr. Caleb Hasler
Department: Biology
Category: Biological Sciences

Abstract: A modified systematic review was conducted using Google Scholar and Web of Science to find studies that investigate repeatability of swimming performance in small-bodied and juvenile freshwater fish. Three filters were applied to compile the most relevant documents. A total of 259 papers were saved and added to an Excel spreadsheet. Investigating the repeatability of a trait can provide insight into the heritability of that trait. It was found that repeatability of swimming performance is not commonly studied in small-bodied and juvenile freshwater fish. Hypoxia, increased pH, metal and chemical contamination, and changing optimal temperature decrease swimming performance. Decreased swimming performance was also found in small and less developed fish. Limited swimming performance studies have been performed on larval and embryonic fish and majority of studies have focused on species in the Cyprinid family. Considering the swimming performance of small fish is valuable when designing culverts to ensure that their populations are not negatively impacted. Further research on repeatability of swimming performance, and swimming abilities of fish from different families of various life stages would be beneficial.

8. **Presenters: Ian McNicol**
"Phylogenetic analysis of the SARS-CoV-2 Clades and Lineages in Canada"

Supervisor: Dr. Sara Good
Department: Biology
Category: Biological Sciences

Abstract: SARS-CoV-2 infects individuals following an interaction between a protein that is expressed on the viral protein coat, called the Spike (S) protein), with the ACE2 receptor that is expressed in multiple human tissues, including the lungs. This makes the S-protein a potential target for vaccine development. Recently, research suggests that a particular mutation on the S-protein, known as the D614G mutation, increases viral infectivity. The original (Wuhan) SARS-CoV-2 virus carried the ancestral (D) amino acid, but the D614G mutation occurred early during the movement of the virus to Europe, and is

now dominant throughout the world. I aligned and annotated the genomes of SARS-CoV-2 samples from Canadian patients that were deposited into a public data repository (GISAID), to determine the frequency of different amino acid mutations, and viral lineages in Canada. Currently, 72% of Canadian COVID-19 patients carry this particular variant, and I describe the amino acids associated with other viral lineages as well. The information garnered by this molecular epidemiological approach can be useful for vaccine development.

9. **Presenters: Emily Van**

"Evaluation of Ferric Chloride Amendment in Reducing Phosphorus Losses from Flooded Soils to Waterways"

Supervisor: Dr. Dashani Kumaragamage
Department: Environmental Studies & Sciences
Category: Biological Sciences

Abstract: Phosphorus (P) is often supplemented to agricultural soils as a way to enhance fertility in crops. During prolonged flooding, P may be released to floodwater and if exported out of fields to lakes downstream, P may contribute to accelerated eutrophication and unwarranted algae blooms. For this study, four intact soil monoliths were collected from Manitoba's Red River Valley region and were amended with ferric chloride in order to evaluate its efficacy in minimizing P losses to floodwater.
Also, I'd like to add that I'm under the "Environmental Studies and Sciences" department

10. **Presenters: Anjila Goel**

"Medicinal Effects of the Methanolic Leaf Extracts of Gongronema latifoliumon a Macrophage Cell Line and Bone Marrow-Derived Macrophage Cells"

Supervisor: Dr. Michael Eze & Dr. Athar Ata
Department: BioChemistry
Category: Biological Sciences

Abstract: Gongronema latifolium is a herb of medicinal and dietary utility in Nigeria. This work revealed that at low (µg/ml) concentrations in vitro, the methanolic extract of the G. latifolium leaf enhanced pro-inflammatory tendencies by increasing cytokine IL-6 production under LPS-induced conditions in the macrophage cell line. However, the extract had no effect on production of nitric oxide (NO) and other cytokines, IL-12p40, and TNF-α in the macrophage cell line, or the bone marrow-derived macrophage cells. This suggests that the health-promoting effects of the herb may derive from the ability to balance pro-inflammatory and anti-inflammatory tendencies in different cells.

11. **Presenters: Nikita Goel**

"Isolation and Purification of Protein Components of Garcinia Kola Seed"

Supervisor: Dr. Michael Eze, Dr. Jamie Galka, & Dr. Athar Ata
Department: BioChemistry
Category: Biological Sciences

Abstract: The tropical flowering plant, Garcinia kola of the Guttiferae family, is one of the traditional herbal medicine sources commonly used by African folk healers. The seed is highly valued in Africa due to its wide range of applications from agricultural produce to natural and orthodox medicines. This study aimed to isolate and purify proteins using ten different methods, determine the protein yield, and illustrate the protein profile of the Garcinia kola seed. The molecular weights of proteins in each sample were estimated using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE).

12. **Presenters: Cassidy Lamirande**

"Testing Rapamycin as a Treatment for White-Nose Syndrome"

Supervisor: Dr. Craig Willis
Department: Biology
Category: Biological Sciences

Abstract: White-nose syndrome (WNS), caused by the fungus Pseudogymnoascus destructans (Pd), has devastated bat populations across North America. One challenge for chemical or biological treatment for WNS is confirming efficacy and safety for animals, humans and the environment. The drug rapamycin is widely used for cancer treatment, has shown antifungal activity, and is known to be safe for mammals. We tested the hypothesis that Rapamycin would inhibit growth of Pd in vitro. We inoculated Rapamycin-treated and control petri plates with Pd and found that Rapamycin inhibited Pd growth. This suggests potential of Rapamycin as a treatment for WNS.

13. Presenters: Sidney Leggett

"Lowering detection limits of the rare earth elements in terrestrial and marine waters without pre-treatment using triple quadrupole ICP-MS analysis"

Supervisor: Dr. Matthew Leybourne
Department: Applied Computer Science
Category: Experimental Physical Sciences

Abstract: Rare earth elements (REE) are important to determine and analyze, as they are used for green technologies, medical imaging and are key to understanding many geological and chemical processes. However, analysis of the REE presents significant challenges. The REE are typically found at trace and ultra-trace concentrations, current analytical technology and methods struggle to reach levels of detection low enough to determine them without extra steps and/or large sample volumes. Techniques being used today involve high resolution ICP-MS; these instruments lose sensitivity needed to reach these limits of detection, when used in high resolution mode. Our study was conducted using recent advances in technology in quadrupole ICP-MS (TQ-ICP-MS) providing an alternative approach – termed here in situ chemical chromatography. This method uses the combination of two analytical quadrupoles and a reaction cell (a TQ-ICP-MS). We present this approach for the analysis of the REE in ground/surface waters from the high Andes and marine waters from an estuary, utilizing iCap TQ from Thermo Fisher Scientific. TQ-ICP-MS is sensitive enough to reach these levels of detection (sub-parts per trillion) it enables the REE to be determined more effectively and efficiently, avoiding mass inferences, contamination, and with minimal sample handling compared to previous methods.

14. Presenters: Kaihim Wong

"Moving toward faster live measurements of axon diameter"

Supervisor: Dr. Melanie Martin
Department: Physics
Category: Experimental Physical Sciences

Abstract: The brain executes many tasks per day and when something goes wrong, the results can be devastating. It is hard to fix neurological disorders because it is difficult to trace the cause of the problem. Axons are the part of brain cells that allow message conduction. Autopsy studies suggest schizophrenia could be related to brain's axon distribution. This needs to be confirmed in living brains. Currently we are working on reducing imaging time for live animals' studies with non-invasive diffusion weighted MRI techniques which can determine the distribution of axons in the brain and provide more insights into diseases such as schizophrenia

15. Presenters: Melissa Anderson

"Mousebed for In Vivo Imaging"

Supervisor: Dr. Melanie Martin
Department: Physics
Category: Experimental Physical Sciences

Abstract: I will present steps toward the development of a technique for in vivo imaging using MRI including the design and construction of a new sample holder, and preliminary data from mouse brains. The method is currently able to detect axons smaller than 5 µm in diameter in live mouse brains in less than 11 minutes.

Inferred axon diameters in the brain ranged from 4-12µm. Verification of the results using electron microscopy is needed. Image optimization is required to begin to understand the role axon diameter changes have in disease and development. This is the first step toward fast live MRI inferences of micron-scale axon diameters.

16. Presenters: Kiera Pond Augusto

"Liquid Deuterium Thermosyphon for an Ultracold Neutron Source"

Supervisor: Dr. Jeff Martin
Department: Physics
Category: Experimental Physical Sciences

Abstract: The TUCAN (TRIUMF Ultracold Advanced Neutron) electric dipole moment (EDM) experiment seeks to measure the neutron EDM with great precision. In the final layer of neutron moderation prior to ultra-cold neutron (UCN) production, a liquid deuterium (LD$_2$) volume surrounds the He-II to efficiently cool the neutrons. This poster describes studies of the engineering design and performance of a natural circulation system (thermosyphon) used to provide cooling to the LD$_2$ volume. A key discovery made through these studies is that the thermosyphon will continue to flow despite the duty cycle from proton beam pulsing at minute-long timescales.

17. **Presenters: Alex Krosney**

"Magnetic Diffusion and Inductive Shielding in a Hollow Conductive Tube"

Supervisor: Dr. Chris Bidinosti
Department: Physics
Category: Experimental Physical Sciences

Abstract: Magnetic diffusion and the related topics of eddy currents and inductive shielding are fundamental concepts in electromagnetism. Despite being present in electrical equipment that we use every day, these concepts are often
overlooked in undergraduate physics. We have created a new experimental method, apparatus, and method of analysis
to be used as a tool for demonstrating these phenomena in an undergraduate laboratory setting. Additionally,
a computer program was created that generates an electromagnetic coil more suitable to these experiments than
traditional coil designs.

18. **Presenters: Seeratpal Kaur Jaura**

"Named Entity Recognition on CORD-19 dataset"

Supervisor: Dr. Sheela Ramanna
Department: Applied Computer Science
Category: Experimental Physical Sciences

Abstract: Named Entity Recognition (NER) is a task to identify, extract and classify named entities from CORD-19 (web-corpus of COVID-19) into predefined categories like coronavirus, chemical, disease. This research explores the foundational and computational challenges of pattern extraction from the CORD-19 dataset with tolerance rough-set based learner (TPL) that could help in many question-answering schemas. The main component for NER involves extraction of patterns from unstructured data and building contextual co-occurrence matrix (CCM) for categorization purposes. This project extracted contextual patterns by identifying the nouns and its contexts in the CORD-19 corpus to derive co-occurrence statistics in order to perform NER in a semi-supervised learning framework.

19. **Presenters: Monalisa Abas**

"Design of New Benzamides as Potential Antibacterial Molecules"

Supervisor: Dr. Tabitha Wood
Department: Chemistry
Category: Experimental Physical Sciences

Abstract: The Truce Smiles Dohmori Rearrangement is a useful, but underutilized, reaction that achieves the formation of a carbon-carbon bond. The reaction is a variation of the Smiles rearrangement in which the intramolecular nucleophile is a carbanion. This project reports the use of ortho-directed lithiation and lithium-halogen exchange as a means of carbanion formation. The rearrangement products are therefore biphenyl compounds. Accompanied with C-C bond formation is also the unveiling of a benzamide functional group. This pharmacophore is suspected to be responsible for the molecules anti-microbial properties.

20. **Presenters: Tapendra BC**

"Feature recognition for photogrammetry of large water Cherenkov detectors"

Supervisor: Dr. Blair Jamieson
Department: Physics
Category: Experimental Physical Sciences

Abstract: A typical large scale water Cherenkov neutrino detector is a cylindrical (eg. 40m tall and 40m diameter) tank filled with ultra-pure water, used to make detailed measurements of solar, atmospheric, and accelerator neutrino. Thousands of photosensors, that record Chernkov rings of light from charged particles produced in neutrino interaction events, cover the inner wall of the tank. The use of the accurate location of photosensors on the wall of the detector will improve the precision in determining if a given event is inside of the detector fiducial volume. Over 15000 images (57GB) of an existing water Cherenkov detector were taken in with an underwater drone with the goal of reconstructing the locations of the photosensors using photogrammetry. In this poster, the location of bolts surrounding each photosensor is determined using image processing techniques.

21. **Presenters: Sarah Baxter**

"Computational Method for Determination of Acid Dissociation Constants in a Series of Organic Molecules"

Supervisor: Dr. Tabitha Wood
Department: Chemistry
Category: Experimental Physical Sciences *(not competing)*

Abstract: Research Abstract – This study sought to evaluate the acidity of a series of related organic molecules by providing estimated acid dissociation constant (Ka) values. The molecules observed were represented electronically; their structures optimized using GAMESS software. Thereby, providing vital information regarding the minima and saddle points along the reaction pathway of each molecule. Preliminarily, it can be concluded that providing a simple and general computational method for predicting the relative acidity of organic molecules by estimating Ka values is of great value to the field of chemistry.

22. **Presenters: Stephanie Connell**

"The University of Winnipeg Participates in a Student-led Space Mission to Study the Effects of Space Weathering"

Supervisor: Dr. Edward Cloutis
Department: Environmental Studies & Sciences
Category: Experimental Physical Sciences

Abstract: Science students from the University of Winnipeg are participating in a student-led space mission. UWinnipeg students as the science team are partnering with engineering students at the University of Manitoba. The engineering students are designing and building a small satellite that will be launched into space in low-Earth orbit. The UWinnipeg science students will monitor the effects of space weathering on geological samples, to see how they respond to the space environment. This will be the first geological space weathering experiment ever done in space and can provide insight into what types of space weathering processes take place on asteroids and the moon.

23. **Presenters: Dilbarjot**

"Automated Ingestion and Data pipeline between The University of Winnipeg and Compute Canada"

Supervisor: Dr. Christopher Henry & Dr. Chris Bidinosti
Department: Applied Computer Science/Physics
Category: Experimental Physical Sciences

Abstract: Machine learning algorithms require large amounts of data to perform tasks with the same performance as humans. The typical size of training data for image recognition applications lies in the order of hundreds of thousands of images. Over the last months, we increased the system's throughput and are now able to generate tens of thousands of images per day. The project's goal is to facilitate the application of machine learning in agriculture and plant sciences. Our datasets and algorithms will be open for use by academics and industry. We will accomplish this by transferring our data from multiple sources to Compute Canada storage.

24. **Presenters: Matthew Marcalinas**

"Biochemical Synthesis of Hypoxanthine 3-N-oxide Derivatives"

Supervisor: Dr. Tabitha Wood
Department: Chemistry
Category: Experimental Physical Sciences

Abstract: We investigated the biocatalyzed synthesis of Hypoxanthine 3-N--oxide (H3NO), a substance that acts as an alarm pheromone for ostariophysan fishes. Three natural enzymes: unspecified peroxygenase from Agrocybe aegerita (AaeUPO), cyclohexanone monooxygenase from Acinetobacter sp. (CHMO), and xanthine oxidase from microbial species (XOD) were proposed for the biosynthesis of H3NO.

25. **Presenters: Silas Leggett**

"COVID-19 Predictions"

Supervisor: Shakhawat Hossain
Department: Math & Stats
Category: Mathematical & Theoretical Physical Sciences

Abstract: In this project, we predicted the total number of deaths due to COVID-19 in Canada for a particular month. We used Worldometer and Github websites to obtain global COVID-19 data from 68 countries for the period of January 01-June 11, 2020. Multiple regression analysis was conducted to predict death count in Canada based confirmed, active, recovered, and death cases and case fatality rates. Our data analysis showed that 95% of the variability of total death is explained by the fitted model. This model predicted 8121 deaths (actual 7994) in Canada on June 11 with 95% prediction interval [3551, 18576].

26. **Presenters: Pukar Rai**

"Resonance Phenomena inPlanetary Systems"

Supervisor: Dr. Murray Alexander
Department: Physics
Category: Mathematical & Theoretical Physical Sciences

Abstract: Resonance phenomena are widely prevalent in the Solar System and in the exoplanetary systems. Systems evolve in to resonance configurations by formatting out of circumstellar disks and migrating to their present configurations. Other possible causes for this evolution are tidal friction with the host star or between the planets or gravitational radiation in dense accelerating bodies such as supernova and binary pulsar. Particular resonances may be stable or unstable to these slow perturbations which cause the system to be trapped in the resonance or escape from it. Such resonance occurrences are dependent on the nature and the speed at which the system evolves. Analytical and numerical studies of the properties of various types of resonance are performed to study long term dynamics of these systems and their stability.

27. **Presenters: Ian Kaye**

"Characterizing Frosty Weather Patterns Near the North American Great Lakes"

Supervisor: Dr. Melody Ghahramani & Nora Casson
Department: Mathematics & Statistics
Category: Mathematical & Theoretical Physical Sciences

Abstract: North-American winters are supposed to be cold. On most winter days, the temperature is expected to dip below zero degrees Celsius. When this occurs, we call that day a frost day. Has climate change already affected the timing of these frost days? To investigate, we've applied flexible statistical models to a large dataset collected near the North-American Great Lakes. This dataset contains measurements for each day of the winter in each year from 1917 to 2016. Spoiler: it's getting hot in here.

28. **Presenters: Antonio Axalan**

"Extreme Winter Temperature Trends in Northeastern Forests of N. America"

Supervisor: Dr. Melody Ghahramani & Dr. Nora Casson
Department: Mathematics & Statistics
Category: Mathematical & Theoretical Physical Sciences

Abstract: The aim of this project was to examine trends in the magnitude of extreme winter temperatures and their timing over a 100-year period for temperatures near the Great Lakes area. Fewer extreme cold days are linked to the invasion of the Southern Pine Beetle. Using a statistical method known as "peaks over thresholds" we identified the period in which the most extreme of cold temperatures occur and found that for two sub-regions, extreme cold temperatures have become less extreme. There is cause for concern with respect to deforestation.

29. Presenters: Aalekh Patel

"Using networks to study containment of infectious disease spread and predicting resource requirements."

Supervisor: Dr. Ortrud Oellerman
Department: Mathematics & Statistics
Category: Mathematical & Theoretical Physical Sciences

Abstract: Motivated by the spread of COVID-19 via physical interactions amongst humans, we devise a mathematical network model that encapsulates some of the spread dynamics of contagions and predicts resource requirements. We use net-works to model physical interactions within communities and develop algorithms for various families of networks that provide insights into ways of responding to pandemics efficiently. Our goal is to compute and identify a smallest number of suspensions of normal interactions that would cause the infection to burn out in a feasible but limited time-frame and to use this reduced interaction network to predict worst-case resource requirements. Our model also allows us to recommend time-frames when normal interactions between certain "social bubbles" can be safely resumed

30. Presenters: Kathleen Watts

"Design and Computational Chemistry of Cyclic Selenoureas"

Supervisor: Dr. Jamie Ritch
Department: Chemistry
Category: Mathematical & Theoretical Physical Sciences

Abstract: Cyclic selenoureas are not well explored as ligands, yet they have many potential applications, such as the use as free radical scavengers and catalysts. The purpose of our research is to design and synthesize feasible metal complexes of cyclic selenourea ligands. Computational chemistry was used design all the ligands and other molecules in the synthesis reactions, as well as to run geometry optimizations and vibrational frequency calculations. The values obtained from the vibrational frequency calculations allowed for the ability to calculate the overall Gibb's free energy changes(ΔG)for the reactions. The Gibb's free energy changes helped us to determine the spontaneity of the reactions. Ligands with a variety of different saturations, substituents, and metals were designed. The unsaturated cyclic selenourea ligands with ethyl substituents were found to be the most spontaneous, therefore; these ligands are most likely to be successful in future experimental synthesis.

31. Presenters: Shawna Skelton

"Lost Horizons: Formation and Evaporation of Regular CGHS Black Holes"

Supervisor: Dr. Gabor Kunstatter & Dr. Jon Ziprick
Department: Physics
Category: Mathematical & Theoretical Physical Sciences

Abstract: We model the evolution spherically symmetric, radiating, non-singular black holes. Coordinate invariant equations of motion are derived from a generalized Callan-Giddings-Harvey-Strominger action. Equations describing the gravitational collapse of a thin spherical shell of matter are solved using a bisection method based non-linear numeric solver. The solutions provide a rigorous description of the black hole's complete dynamical history, from its birth to its death (complete evaporation).

32. Presenters: Michael Grehan

"Calculating Holographic Complexity in AdS"

Supervisor: Dr. Andrew Frey
Department: Physics
Category: Mathematical & Theoretical Physical Sciences

Abstract: Hawking radiation gave rise to the information paradox which has led physicists to believe a better understanding of gravity is needed to create a theory of quantum gravity. Calculating information quantities, such as complexity, that correspond to a black hole may help provide this understanding. Previous work to calculate holographic complexity in AdS has been done in a simplified manner that allowed analytical solutions. Our work calculates the complexity using numerical methods, in a non-simplified manner, which will allow us to better understand the quantum state of a forming black hole.

33. **Presenters: Michael Kvern**

""Watt" does energy security mean in the North? The need for local agency and efficiency."

Supervisor: Dr. Patricia Fitzpatrick
Department: Geography
Category: Social Sciences

Abstract: This research begins the process of developing a community energy plan (CEP) for Churchill, MB. CEPs illustrate energy usage and identify opportunities for future change. Primary data involved energy use data, key informant interviews and a community workshop. Churchill's energy portfolio is 50% electricity but includes 4 million litres of fossil fuel for local transport and heating. When air travel fuel is included, fossil fuel consumption changes dramatically. Residents express strong interest in changing to local renewable options including solar and wind. A strong desire for agency – local control over generation and distribution was also expressed by residents. This research produced a vision statement for Churchill's CEP, along with baseline data to enable future planning and upgrades.

34. **Presenters: Anya Ingram**

"Mural Art and Public Space Quality in Winnipeg's West End"

Supervisor: Dr. Marc Vachon
Department: Geography
Category: Social Sciences

Abstract: This research project explores the relationship between public art and public space. The research aims to evaluate and assess the current and previous existence of public mural art within the West End neighborhood of Winnipeg, Manitoba (MB), in order to determine how murals may be linked to the commercialization and branding of public space. The goal is to create a framework which can inform mural-based tourism; ensuring that it is carefully considered to ensure the public art positively represents a community and improves the environment

35. **Presenters: Tekla Cunningham**

"Characterization of Distinguishing Traits of Zea mays and Ipomoea batatas Starch Grains"

Supervisor: Dr. Yadira Chinique de Armas
Department: Anthropology
Category: Social Sciences

Abstract: Starch grain analysis is important for paleodiet reconstruction. Identification of plants occurs after analysis of traits and comparison to a reference collection. There are several plants that are often mistaken for each other. Sweet potato (Ipomoea batatas) and maize (Zea mays) can be confused for each other because of similarities in several diagnostic traits like shape, size, and presence of fissures. These misidentifications can lead to skewed representations of the cultural and dietary practices of a population. Sweet potatoes were staple foods in diets and are quite easy to grow, while maize was also used during ritual activities and requires more effort to cultivate. We compiled a list of diagnostic traits for both maize and sweet potatoes based upon examination of 500 grains from each plant. Key traits identified include the presence of double border for maize and the presence of lamellae for sweet potatoes, as well as secondary traits such as the shape, size, and presence of fissures and pressure facets on each plant. The presence of one of the species-specific traits in conjunction with others that fit the diagnostic criteria is sufficient to obtain a secure identification for I. batatas and Z. mays.

36. **Presenters: Lara Penner-Goeke**

"A Meta-Analysis of Group-Based Parenting Programs for Preschoolers"

Supervisor: Dr. Justin Frieson & Dr. Leslie E. Roos
Department: Psychology
Category: Social Sciences

Abstract: Group-based parenting programs have been researched and implemented in families for over 50 years as a meaningful way to promote child health and well-being, but some evidence suggest that their effects are limited and can be inconsistent (Barlow et al., 2016; Buchanan-Pascall et al., 2018; Furlong, McGilloway, Bywater, Hutchings, Smith, et al., 2012). To inform next steps in program development, more information is needed about the efficacy of such programs during specific developmental time periods (i.e., 3-5 years) along with examinations of for whom programs work best and the extent to which intervention components affect program efficacy. To answer

these questions, a systematic review and meta-analysis of randomized-controlled-trials for group-based parenting programs in preschool aged children was conducted from 2000 to 2020. Sixty-five articles evaluating group-based parenting programs for preschoolers were included. Results showed that group-based parenting programs have small, but meaningful effects on child and parenting outcomes during the preschool age, but innovation in program development is needed to increase efficacy and continue to examine which families need additional services or alternative treatment approaches.

37. **Presenters: Christine MacKay**

"An Event-Related Potential (ERP) Examination of the Neural Response to Emotional and Movement-Related Images"

Supervisor: Dr. Stephen Smith & Dr. Amy Desroches
Department: Psychology
Category: Social Sciences

Abstract: Previous research on the independent effects of emotional and movement-related stimuli have been shown to influence the brain's electrical activity, which corresponds to attentional and cognitive processes. In the current research, electroencephalography (EEG) was used to measure the brain's activity while participants viewed emotional and/or movement-related images. Early (200-300ms) and late (500-1000ms) responses were larger when viewing either emotional stimuli or movement-related stimuli. Further, emotion and movement interacted during the late response to produce larger effects than either characteristic alone. This research highlights the importance of emotion and movement interactions during visual perception.

38. **Presenters: Lara Kinsman**

"Making the Personal Political: Self Versus Group Focused Rumination Following Sexual Harassment"

Supervisor: Dr. Lisa Sinclair & Dr. Paul Trapnell
Department: Psychology
Category: Social Sciences

Abstract: The 1960's rallying cry "the personal is political" and more recent social movements such as #MeToo and #TimesUp argue that when personal pain is group-based oppression, individuals should address personal pain via collective action to effect cultural change. Thus, the current research sought to demonstrate that group-focused construals of personally negative events yield more adaptive outcomes than self-focused construals following personally negative life events. To this end, a scale was developed to measure group-based as well as personal-based rumination within the context of perceived unwelcomed events related to sexual harassment. Consistent with past research, personal post-harassment rumination was positively associated with other measures of maladaptive rumination and emotional maladjustment. In contrast, group-based post-harassment rumination was positively associated with measures of adaptive rumination and critical consciousness. Moreover, group-based post-harassment rumination mediated the association between sexual harassment and critical consciousness. This suggests rumination after personal sexual harassment experiences can enhance political motivation for social change to the extent that it prompts identification of event related personal harm with the experiences of other members of one's group.

Keywords: sexual harassment, rumination, maladjustment, critical consciousness