

19th Randy Kobes Undergraduate Research Symposium

The 19th 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.

2024

November 13, 9:30 – 12:30pm

JUDGES REVIEW

12:30 – 1:30pm PUBLIC VIEWING/RECEPTION

Sponsored by Research Manitoba

November 15, 12:30 – 1:30pm

AWARDS CEREMONY

In conjunction with the flipped 3MT event held in
Leatherdale Hall



THE UNIVERSITY OF WINNIPEG

RANDY KOBES

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.

AWARD CEREMONY Acknowledgments

Thank you to those who were a part of the Awards Ceremony on November 15.

Jino Distasio – Acting Dean of Science & Professor

Tabitha Woods – Associate Dean & Associate Professor Chemistry

Glen Bergeron – Faculty member in the Gupta Faculty of Kinesiology & Applied Health at UofW, and MMSF Representative

SPONSORS:

We gratefully acknowledge sponsorship from:

The University of Winnipeg Dean of Science Office



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Research Manitoba, Sponsor of the Reception



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**Manitoba Medical Services Foundation (MMSF),
Sponsor of the new Health Science prize**

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GUEST JUDGES:

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

Akshi Malik – Program Officer, Health, Knowledge Translation & Mobilization

Ashley King – Program Officer, Research Manitoba

Blake Podaima – Principal, Virtuistix Inc.

Brianne Selman – Scholarly Communications & Copyright Librarian

Bryanne Lamoureux – Research Associate, Enso Co-Lab

Carolyn Garland – Awards & Communications Officer, Faculty of Graduate Studies

Corey Sanderson – UW Alum

Dennis Gupa – Department of Theatre & Film

Emile Kobes – UW Collegiate alum & daughter of Randy Kobes

Ian Fraser – Librarian, Head of Reference & Instruction

Janelle Hacault – Business Development Manager, Bioscience Association of Manitoba

Janice Reyes Bain – Administrative Assistant to the Dean, Library

Jitendra Paliwal – Vice-President, Research & Innovation

Kathryn Boschmann – Research Project Director, Manitoba Indigenous Tuberculosis History Project

Kent Suss – Budget, Programs & Priorities Officer, Faculty of Graduate Studies

Kerrie Hayes – Director, Research Contracts, University of Manitoba

Leanne Fontaine – UW alum & daughter of Randy Kobes

Matt Morison – Water Science and Watershed Management Branch, Manitoba Environmental and Climate Change, Gov. of MB

Sarah Kobes – UW alum & daughter of Randy Kobes

Sylvia Furtado – Program & Research Coordinator aabijjiwan New Media Lab + The Space

Yasmin Iman – Program Officer, Research Manitoba

1. Presenter: Jasper Robb

“Formalizing Proofs from Combinatorics on Words in Lean”

Supervisor: James Curry

Department: Mathematics

Category: Mathematical & Theoretical Physical Sciences

Abstract: In mathematics, it's useful to be able to tell whether a proof is correct or not. The programming language Lean offers a way to systematically check our proofs with a computer. By using Lean, we can be sure that we haven't missed any errors or hidden assumptions. We've implemented several definitions and proofs from the field of Combinatorics on Words in Lean.

2. Presenter: Renru Chen & Zijun Yan

“What is the best testing condition to get the products?”

Synthesis of Truce-Smiles Rearrangement Substrate”

Supervisor: Tabitha Wood

Department: Chemistry

Category: Experimental Physical Sciences

Abstract: The Truce-Smiles Rearrangement involves intramolecular nucleophilic aromatic substitution, where a halide leaving group is replaced by a carbon nucleophile. This study investigates the reaction of hydroxyacetophenone with ethyl 4-bromobutyrate, achieving a remarkable 100% purity under optimal conditions of acetonitrile, 82°C, 24 hours on the synthesis of o-EAB and p-EAB. This research empowers future chemists to streamline the optimization process for preparation of substrates for use in the Truce-Smiles Rearrangement synthesis, significantly reducing the time required to identify ideal conditions while enhancing the purity of the final product. Future research will aim to replicate these experiments on a larger scale and to reduce the errors.

3. Presenter: Searra Warnock

“Electrochemical Detection of Chemoresistance in Living Ovarian Cancer Cells”

Supervisor: Sabine Kuss, Dhesmon Lima

Department: Chemistry

Category: Health Sciences

Abstract: Chemoresistance, enabling cancer cells to withstand chemotherapy, is responsible for the majority of cancer treatment failures.¹ Modern methods of detecting chemoresistance are inefficient, which impacts treatment success rates.² Scanning Electrochemical Microscopy (SECM) is an electroanalytical technique

that uses an ultramicroelectrodes to quantify molecule efflux from living cells, through the analysis of changes in measured electrochemical current. In this study, SECM measures glutathione (GSH), a biomarker associated with chemoresistance. This study experimented on PEO6, a patient-derived resistant ovarian cancer cell line. Ferrocenemethanol, a redox mediator, was added to the cell-containing solution as indicator for GSH and SECM line scans across cells was performed. The results indicate that chemotherapeutics affect the efflux of biomarkers, depending on a cell's degree of resistance, demonstrating the potential of chemoresistance detection using SECM.

4. Presenter: Thomas Hepworth
“Superconducting Electrical Joint Development for the BASE Coil System at CERN”

Supervisor: Barbara Maria Latacz & Jeff Martin
Department: Physics
Category: Experimental Physical Sciences

Abstract: The Baryon Antibaryon Symmetry Experiment (BASE) makes world leading precision measurements of the fundamental properties of protons and anti-protons to look for CPT violation in the standard model of particle physics. To keep improving measurements BASE must have very strong control of the systematics of the experiment, primarily the magnetic field. BASE exists inside CERN's Antimatter Factory in Geneva, Switzerland, where the magnetic field is fluctuating due to the different decelerator magnets. In order to achieve a magnetic field that is homogeneous and stable over time, BASE must implement a superconducting coil system which allows them to tune the magnetic field in their measurement traps. I will discuss the coil system and its requirements for improved superconducting electrical joints in order to improve the performance of the system.

5. Presenter: Anna Harms
“How to ray trace a cone. (Hint: They aren't spheres)”

Supervisor: Blair Jamieson
Department: Physics
Category: Mathematical & Theoretical Physical Sciences

Abstract: Ray tracing is the process of rendering an image by simulating the behaviour of light rays within a scene. The photogrammetry team of the Hyper-Kamiokande collaboration are utilizing this in generating realistic images to be used in testing photogrammetry software. One of the candidate ray tracing codes needed a new cone class in order to render objects with cone geometry. In order to construct a cone class, two main components

were added. The first was a mathematical definition of the cone-ray intersection, used in determining if a given ray intersects or “hits” the cone. The second is to determine the new direction of the ray after hitting the cone. For this, an algorithm to determine the normal vector at the point of intersection was required and implemented.

6. Presenter: Mackenzie Bourbonnais
“The Dark Tetrad and Detecting Past Cybervictimization”

Supervisor: Erin Buckets
Department: Psychology
Category: Social Sciences

Abstract: Past research suggests that Machiavellianism, psychopathy, and sadism predict greater accuracy in decoding cues of past victimization by physical or sexual assault. Less understood are trait predictors of cybervictimization judgements, which was the focus of this research. In Study 1, participants (N = 50) completed self-report measures of cybervictimization experiences and provided screenshots of their Instagram profiles. In Study 2, participants (N = 292) completed a survey including measures of aversive traits. Participants then viewed eight Instagram profiles and decided whether the person in the profile had been victimized on Instagram in the past year. Sadism was negatively associated with the accuracy of cybervictimization judgements, particularly when judging non-victim profiles. These findings suggest individuals high in sadism have poor predatory insight and a tendency to overgeneralize cybervictimization status.

7. Presenter: Nicole Valencia
“Deep learning approaches for automatic urethral segmentation in high-dose-rate prostate brachytherapy using transrectal ultrasound images”

Supervisor: Jessica Rodgers
Department: Physics
Category: Health Sciences

Abstract: Prostate cancer is among the most commonly diagnosed cancers and is the third leading cause of cancer related death among Canadian men. High-dose-rate (HDR) prostate brachytherapy is a specialized radiation therapy for localized prostate cancer that involves placing radioactive isotopes directly into the patient. Accurate segmentation of the prostate and surrounding organs from clinical imaging are crucial for targeting cancer cells while sparing healthy tissue, however current manual segmentation methods are time-consuming and prone to clinician variability. This project investigates the use of a U-Net convolutional neural network to automate urethra

segmentation in prostate brachytherapy transrectal ultrasound images, aiming to improve segmentation accuracy, clinical workflow efficiency, and patient outcomes.

8. Presenter: Igal Press

“Dilepton Ring Detection in the HADES RICH Detector”

Supervisor: Johan Messchendorp

Department: Physics

Category: Experimental Physical Science

Abstract: The decay of the Sigma hyperon into a Lambda and a dilepton pair has been theorized to be an incredibly rare decay mode ($<5 \cdot 10^{-3}$), and the detection of this Dalitz decay is being prepared for in the next run at GSI Helmholtzzentrum in Darmstadt, Germany. The dilepton pair produced during this decay will release Cherenkov radiation in the HADES RICH (Ring Imaging Cherenkov) Detector signaling the existence of this decay mode. A machine learning algorithm based in the previously established U-NET algorithm was created to not only detect multiple overlapping Cherenkov rings and log their respective coordinates, but also to remove background radiation from the sample.

9. Presenter: Kiersten Hiebert

“Dye Sensitization of Zinc Oxide Nanowires with Derivatives of [Ru(bpy)3]2+”

Supervisor: Marek Majewski

Department: Chemistry

Category: Experimental Physical Science

Abstract: Hydrogen fuel is an important alternative energy source to address climate change as it produces water instead of carbon dioxide as a when burned. We made dye sensitized photo electro-synthesis cells with zinc oxide nanowire crystals on glass in the hopes of splitting water into hydrogen fuel and oxygen with light. A dye sensitized photo electro-synthesis cell was created by soaking the zinc oxide nanowires in a Ru(bpy)₃ dye solution in order to anchor the dyes to the crystal surface. When light is shone on these dye-soaked crystals, the dye absorbs white light energy and then uses this energy to drive a chemical reaction. By doing this the system can convert light energy into chemical energy. This reaction has potential to produce hydrogen fuel from water.

10. Presenter: Fatim Diaby

“Developing Targeted Therapies for Triple Negative Breast Cancer”

Supervisor: Anuraag Shrivastav

Department: Biochemistry

Category: Biological & Environmental Sciences

Abstract: In 2024, an estimated 30,000 Canadian women are expected to be diagnosed with breast cancer (BC), with a projected 5,500 deaths. Among BC cases, Triple-Negative Breast Cancer (TNBC) accounts for 10%. It is characterized by the absence of estrogen and progesterone receptors, as well as the Human Epidermal Growth Factor 2 (HER2) protein. As a result, TNBC currently lacks targeted therapy. Our laboratory has identified N-myristoyltransferase 2 (NMT2) as a potential target for developing a therapeutic strategy. NMT2 facilitates N-myristoylation and acts as an oncoprotein, promoting the growth and metastasis of TNBC cells. We have discovered two promising small molecules, ONDX1 and ONDX2, that specifically target NMT2 and may serve as potential drug candidates for the targeted therapy of TNBC. My research highlights their effect on breast cancer cells.

11. Presenter: Ella Russell

“Understanding Phosphorus Transport Mechanisms in Southern Manitoba to Reduce Nuisance Algal Blooms”

Supervisor: Nora Casson

Department: Geography

Category: Biological & Environmental Sciences

Abstract: Phosphorus (P) is one of the two key contributors to nuisance algal blooms in downstream water bodies. To reduce the frequency of algal blooms and improve water quality in highly impacted areas, it's important to understand how P is hydrologically transported from landscapes to water bodies. Previous research in southern Manitoba has demonstrated that the relationship between stream discharge and phosphorus concentrations can give insights to the sources and seasonal predictability of algal blooms. Data obtained from the Lake Winnipeg Basin Community Based Monitoring Program. The results show that streams fall into three categories: P concentrations increasing with discharge, no relationship between P concentrations and discharge, and a threshold relationship where P concentrations increase during high discharge. These results may influence targeted land management to improve water quality.

12. Presenter: Ardita Ibrahimaj

“Sacred Values and Decision Making: An Eye-Tracking Study”

Supervisor: Justin Friesen

Department: Psychology

Category: Social Sciences

Abstract: Sacred values (SVs) are core, non-negotiable principles such as justice, family, and honor, which individuals often rely on when making moral decisions. Prior research has suggested that the inclusion of SVs in moral dilemmas influences decision-making by guiding individuals toward choices that align with these deeply held values. Our study investigated the role of attentional control in decision-making when individuals are confronted with moral dilemmas involving tragic, taboo, or secular trade-offs. Using eye-tracking technology, we assessed how participants' gaze patterns influenced their choices. Thirty introductory psychology students (22.34 ± 9.01 years; 11 male) were presented with short scenarios, and their attentional focus was measured through heat maps showing gaze distribution. Our results confirm that attentional control is a significant predictor of decision outcome, with increased attention to a particular option correlating with its selection. These findings suggest that attentional mechanisms play a crucial role in how individuals navigate moral dilemmas involving SVs.

13. Presenter: Tomer Levi Avshalom

“Fungal Antibiotics: A Quest for Novel Antimicrobial Agents in Manitoban Fungi”

Supervisor: Paul Holloway

Department: Biology

Category: Biological & Environmental Sciences

Abstract: With the rise of antibiotic resistance in medicine and agriculture, it is imperative to find novel compounds that can overcome this upsurging obstacle. One such source is kingdom Fungi, with reputable history of producing bio-active compounds with antibiotic properties. Local Manitoban fungal samples were collected and underwent fermentation and subsequent extraction in search for bio-active compounds. Extracts that demonstrated antibacterial activity against Gram-positive and Gram-negative bacteria underwent further separation through column chromatography and analyzed using other analytical chemistry techniques (HPLC, GC-MS, and NMR). The extracts were identified as patulin mycotoxins, trialed to treat the common cold, and provided an interesting prospect for the variety of compounds produced by fungi.

14. Presenter: Chloe Stimpson

“From Snow to Sunshine: An Exploration of Recess in Varied Environments”

Supervisor: Brenton Button & Will Burton

Department: Education

Category: Social Sciences

Abstract: Recess is essential for student play, but climate change is increasing hot days and altering precipitation, which may affect recess. This study aims to examine play during indoor and outdoor recess.

Methods: Data were collected from two schools with 3rd and 4th graders ($n=23$) using a multi-tool (observations, children's drawings, and interviews) and a multi-time point approach (indoor, winter, spring). Drawings and observations were coded with the Tool for Observing Play and analyzed using frequencies. Interviews were analyzed through content analysis.

Results: Play involving gross motor activities and bioplay was most common during outdoor recess, and there were increases in digital play during indoor recess.

Discussion: Indoor recess lacks gross motor and bioplay, which are vital for children's health. Classrooms should be designed to facilitate these types of play.

15. Presenter: Madelyn Timmins

“One, Two, Three, Count With Me: The Neural Mechanisms Involved In Number Word Processing”

Supervisor: Stephanie Bugden & Amy Dsroches

Department: Psychology

Category: Social Sciences

Abstract: Learning the meaning of number words is an important accomplishment in a child's math development. Children who fail to learn the meaning of number words before school-age are at a higher risk of experiencing challenges when learning different math concepts. The neural correlates that support number word development is poorly understood. The goal of the current study is to use Functional near infrared spectroscopy (fNIRS) to replicate previous neurological findings on the brain areas involved during number-word processing.

25 adults passively listened to number words while simultaneously seeing either a matching or non-matching quantity of eggs ranging from one to four presented on a computer screen. Based on previous findings, it was hypothesized that adults will show a neural congruity effect in the left IPS and the anterior-cingulate cortex.

16. Presenter: Taryn Brandt

“Timing is Key: The Effect of Fermentation Duration on Natural Product Anti-Microbials”

Supervisor: Paul Holloway

Department: Biology

Category: Biological & Environmental Sciences

Abstract: Antibiotics are essential for treating and controlling infectious agents, such as pathogenic bacteria. However, antibiotics have been grossly overprescribed, leading to a significant problem with antibiotic resistance. In an effort to address this, an endophytic fungus obtained and studied for its potential to produce natural antimicrobial compounds. Fermentations were performed over various time frames using Sabouraud dextrose broth with an additional 40 grams of dextrose as the growth medium. The following test organisms were used: Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, and Pseudomonas aeruginosa. As the time of fermentation increased, the overall production of antimicrobials decreased. The optimal time of fermentation to maximize anti-microbial production was seven days. At five days, the antimicrobial activity decreased by an average of 11%, 15% by nine days, and 13% by eleven days.

17. Presenter: Leeza Goldberg

“Milk Extracellular Vesicles Attenuate Microglial Apoptosis for Enhanced Neuroprotection”

Supervisor: Sanoji Wijenayake

Department: Biology

Category: Health Sciences

Abstract: Early life stress induces inflammation and cell death (apoptosis) in neonates, particularly affecting the brain during critical postnatal periods. Microglia, the brain’s resident immune cells, play a key role in these responses. Milk extracellular vesicles (MEVs), a type of fat droplet abundant in milk, have anti-inflammatory properties, though their mechanisms remain unclear in the brain. This study investigates whether MEVs can combat microglial cell death resulting from inflammation. The transcript and protein abundance of candidate pro- and anti-apoptotic targets has been examined, and candidate MEV-microRNAs with direct post-transcriptional potential will be analyzed in the future. These findings will highlight MEVs’ potential to mitigate neuroinflammation-induced cell death in baseline and polarized microglia, offering insight into potential interventions for addressing neurodevelopmental disorders linked to early life stress.

18. Presenter: Tia Alsaidi

“Subclinical Sadism and Psychopathy as Predictors of Recognition Accuracy of Primary and Secondary Emotional Expressions”

Supervisor: Justin Friesen & Erin Buckets

Department: Psychology

Category: Social Sciences

Abstract: Theorists have proposed a ‘Dark Tetrad’ of socially aversive personality traits, adding subclinical sadism (a tendency to derive pleasure from others’ suffering) to the previous ‘Triad’ of subclinical psychopathy, Machiavellianism, and narcissism. However, some have questioned whether sadism is sufficiently distinct from psychopathy. We used an emotion recognition task combined with eye-tracking to investigate the distinctiveness of sadism and psychopathy. Participants were asked to identify primary and secondary emotional expressions while their gaze was tracked. Aversive personality traits were measured by the Short Dark Tetrad scale. Regression analyses found that while psychopathy uniquely predicted reduced recognition accuracy, sadism uniquely predicted increased recognition accuracy. Gaze data did not find that SD4 traits predicted dwell times to facial features. Emotion recognition results provide additional evidence for the behavioral distinctiveness of sadism.

19. Presenter: Rylen de Vries

“UCN Guide Fabrication: Mechanical Polishing Exploration”

Supervisor: Russell Mammei

Department: Physics

Category: Experimental Physical Sciences

Abstract: The TUCAN project will measure the electric dipole moment of the neutron. To do this, a wave guide tube must be used to get neutrons from where they are produced to the detector setup. The guide tubes need to be very smooth to give good neutron transmission and has so far relied on a facility in the United States to polish them, but this is costly and time-consuming. In this project I explored the possibility of polishing the guide tubes in a local machine shop by rotating a test guide tube on a lathe filled with various media. Ceramic media roughened the semi-polished surface of the test tube, but plastic and treated corn cob reduced the surface roughness, however not to the level required for the TUCAN project.

20. Presenter: Sheriden Wagner

“Myxobacteria as a Possible Blackleg Treatment”

Supervisor: Paul Holloway

Department: Biology

Category: Biological & Environmental Sciences

Abstract: One of the most serious fungal pathogens of canola is *Leptosphaeria maculans* (blackleg). Current management options, fungicides, crop rotation, and resistant cultivars, have limited protective effect. Myxobacteria, bacteria which cooperatively hunt other microorganisms, may be an option for the biocontrol of blackleg. Twelve isolates of putative myxobacteria were isolated from Manitoban soil. These isolates were all shown to be Gram-negative rods which formed distinctive fruiting bodies, characteristics consistent with Myxobacteria. Several of these isolates were demonstrated to swarm and attack *E. coli* and *M. luteus* colonies on agar plates. Colony lysis was observed. If this activity extends to *Leptosphaeria maculans* then Myxobacteria can be a biocontrol strategy for the protection of canola.

21. Presenter: Esme Franck

“Milk and microglia: Milk extracellular vesicles regulate your brain’s immune response”

Supervisor: Sanoji Wijenayake

Department: Biology

Category: Health Sciences

Abstract: Early in life, neonates’ immune system is underdeveloped, making them vulnerable to infections. Breast/chest milk can compensate for deficiencies in the neonatal immune system and contains important biological components like milk-derived extracellular vesicles (MEVs). MEVs are fat droplets with anti-inflammatory properties. They survive digestion and can even enter the brain. But their immune effects in the brain remain unknown. My research aims to investigate the anti-inflammatory effects of MEVs on microglia, an important immune cell in the brain. I will quantify a list of homeostatic, pro-inflammatory and anti-inflammatory markers in microglia cells that received MEVs prior to an immune stress. Our goal is to highlight the pro-survival properties of MEVs, support breast/chest milk feeding, and explore therapeutic potentials of MEVs.

22. Presenter: Claire Sedgwick

“Phoneme Perception in Children with and Without Reading Difficulty”

Supervisor: Amy Desroches

Department: Psychology

Category: Social Sciences

Abstract: Many children struggle acquiring reading skills despite having typical intelligence. Although there is a consensus that deficits in phonology underlie reading difficulty, the precise basis of these deficits remains unclear. In the present study we measured event-related potential (ERPs), a brain response measure during a picture-spoken word matching task designed to examine subtle aspects of speech processing. We manipulated coarticulatory cues of word initial sounds in both matching and mismatching conditions (e.g., correct coarticulation: HAT-hat, HAT-hot, incorrect coarticulation: HAT-hoat, HAT- haot). We examined whether ERP components were modulated differently for each condition. Preliminary findings indicate a greater modulation of a later ERP component for mismatches conditions compared to the match conditions. The results have implications for understanding the relationship between spoken word recognition and reading development.

23. Presenter: Khushneet Kaur

“Hidden treasures: Discovering new antibiotics in 5g of soil from riding mountain national park, Manitoba”

Supervisor: Paul Holloway

Department: Biology

Category: Biological & Environmental Sciences

Abstract: This study explores the potential of soil from Riding Mountain National Park as a source of new antibiotics. A 5 g soil sample was processed to isolate bacteria and extract antibiotic compounds. The soil was suspended in distilled water, allowing solids to settle before transferring 1 mL of the solution to agar plates. Using Amberlite XAD-7HP resin, antibiotics were retained from the solution through methanol washes and evaporation. Twenty distinct bacterial colonies were isolated and tested against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Escherichia coli*. The best-performing isolates were purified, leading to the preparation of antibiotic discs for further susceptibility testing. This research underscores the importance of natural soil environments in discovering novel antibiotics amid rising antibiotic resistance concerns.

24. Presenter: Taylor Cangemi

“Rates of re-sighting error and tag loss for endangered little brown bats double-marked with PIT tags and forearm bands”

Supervisor: Craig Willis

Department: Biology

Category: Biological & Environmental Sciences

Abstract: Wildlife researchers mark individuals to address many ecological questions. Common marks for bats are forearm bands and sub-cutaneous transponders (PIT tags). Re-sighting errors and tag loss could affect population estimates but comparisons of band and PIT-tag errors are rare. We compared errors for PIT tags and bands using double-marked, little brown bats (*Myotis lucifugus*) from two datasets: (1) 75 bats from 2008-2019 in central Canada; (2) 36 bats from 2012-2023 in Newfoundland and Labrador. More bats lost PIT tags (Dataset 1: 20%; Dataset 2: 14%) than bands (Dataset 1: 1%; Dataset 2: 0%). Other errors likely included misreads and failed detections, but these are difficult to distinguish from tag loss. Our results suggest that accounting for tag loss will be crucial for monitoring population status of endangered Canadian bats.

25. Presenter: Olivia Shyiak

“Characterizing Children’s Ordinal Processing Abilities for Sequences Inconsistent with the Traditional Count-List.”

Supervisor: Stephanie Bugden & Brandon Goulding

Department: Psychology

Category: Social Sciences

Abstract: Ordinality is an important foundation for learning math; however, children in kindergarten and first grade, as well as those with severe math learning disabilities often struggle to recognize non-adjacent sequences (e.g., 2-4-6) as ordered (Hutchinson et al., 2022; Slipenkj et al., 2024). We examined whether children continue to struggle to order non-adjacent sequences across a series of contexts. Although we replicated prior findings that children classified non-adjacent sequences such as 2-4-6 as out-of-order, they can touch the numbers in order from smallest to biggest in an order production task. These findings suggest that measures of ordinality tap into distinct cognitive processes. In our next study, we plan to explore the nature of ordinal processing skills in real-world contexts, such as ordering a book series.

26. Presenter: Jadyn Piatt

“The effect of diet on gametogenesis and embryo survival in Japanese medaka (*Oryzias latipes*)”

Supervisor: Sara Good

Department: Biological Sciences

Category: Biological & Environmental Sciences

Abstract: In aquaculture and laboratory settings it is becoming increasingly popular to transition fish to plant-based diets as a cost-effective alternative to animal-based diets. However, there are concerns that plant-based diets may not contain sufficient nutrients for proper reproduction. For my thesis, this study will examine the impact of three diets on gametogenesis in young (3-month) and older (13-month) cohorts of Japanese medaka (*Oryzias latipes*). The three diets differ in their protein source and macronutrient compositions. The hypothesis is that the plant-based diet will induce enteritis, intestinal inflammation, thereby lowering investment in gametogenesis, and that young fish will be impacted. We will test this hypothesis by using histological methods to assess germ cells, measuring changes in expression of genes involved in gametogenesis, and examining the survival of offspring.

27. Presenter: Caitlin Damm

“Gender Disparity in Sentencing Outcomes in Canada: An Analysis of Sexual Crimes Against Children”

Supervisor: Marcella Siqueira Cassiano

Department: Criminal Justice

Category: Social Sciences

Abstract: In Canada, sexual offence sentencing outcomes seem to vary significantly depending on gender of the perpetrator. Previous research on sexual offences committed by females are equally intrusive as those committed by males. However, females usually receive shorter sentences. My honours research project focuses on outcomes for sexual offences against children/youth, as this population group is more frequently victimized. I analyze the following crimes against children: (1) sexual assault (level 1), (2) sexual interference, and (3) invitation to sexual touching. I selected these crimes because of their high prevalence. Cases span over 20 years (2004-2024) and were identified by searching Rangefinder, a private service that compiles sentencing reports in Canada. Gender disparity in sentencing can compromise the due process and discourage victims from reporting sexual offences.

28. Presenter: Jerzy Halas

“The Effect of Psilocybin on Serotonin Levels in C. elegans”

Supervisor: Paul Holloway

Department: Biology

Category: Biological & Environmental Sciences

Abstract: The therapeutic effect of psychedelics is mediated through serotonin; a neurotransmitter responsible for the regulation of physiological and behavioural processes, and neuropsychiatric disorders. In the model organism, *Caenorhabditis elegans*, serotonin enhances a slowing response. A locomotion assay was developed to qualitatively assess the serotonin in the worms by measuring the number of body bends per 20 seconds under controlled conditions, and when dosed with the SSRI fluoxetine and Psilocybin. Psychedelics such as Psilocybin, act as serotonin receptor agonists, enhancing the activation of serotonin receptors. The level of serotonin was therefore hypothesized to increase when the worms were microdosed with Psilocybin. The average number of body bends significantly decreased in the worms dosed with the SSRI and Psilocybin. The increase in serotonin is indicative of the potential therapeutic effects of Psilocybin.

29. Presenter: Brandon Wittmeier

“The Origin of the Universe: Was there a Beginning of time?”

Supervisor: Evan McDonough

Department: Physics

Category: Mathematical & Theoretical Physical Sciences

Abstract: Throughout the month of May, I have taken a look at a complex question in cosmology: does time have a beginning or, is time eternal? Through cosmology, we were able to make assumptions about time, from its effects on the early stages on the universe.

30. Presenter: Jessica de Kort

“Catheter tip localization in prostate brachytherapy ultrasound images using a deep learning and feature extraction pipeline”

Supervisor: Jessica Rodgers

Department: Physics

Category: Health Sciences

Abstract: High-dose-rate brachytherapy treats prostate cancer by inserting 16–18 catheters, guided by transrectal ultrasound (TRUS) into the prostate. Catheters may bend during insertion, complicating localization and extending procedure time, increasing risks from prolonged anesthesia. Advanced tools aim to reduce procedure duration by automatically localizing curved catheters in 3D TRUS images. A deep-learning and feature extraction pipeline was used,

where 3D U-Net architecture generated point-cloud predictions, refined with a 3D Hough transform. A dataset of 67 training and 21 testing patients were utilized and passed through the pipeline. Results yielded an average Dice coefficient of 0.42, catheter shaft distance of 1.9 mm, tip distance of 3.0 mm, and a Hausdorff distance of 1.4 mm. Further refinement is needed to enhance catheter localization, reducing risks associated with anesthesia.

31. Presenter: Smit Panchal

“Self-Interacting Fuzzy Dark Matter”

Supervisor: Evan McDonough

Department: Physics

Category: Mathematical & Theoretical Physical Sciences

Abstract: Dark matter is five times more abundant than visible matter, and yet its identity as a fundamental particle remains elusive. Fuzzy Dark Matter is a proposal to explain dark matter relying on quantum mechanics operating on astrophysical scales. I will present some of the key aspects of fuzzy dark matter, and the role that self-interactions may play in the dynamics of fuzzy dark matter halos

32. Presenter: Xiao Zhang

“Estimating Progression of Alzheimer’s Disease with Extracellular Vesicle-Related Multi-Omics Risk Models”

Supervisor: Qian Liu

Department: ACS

Category: Health Sciences

Abstract: Alzheimer’s disease (AD) is a cognitively destructive disease that greatly reduces quality of life. Our current understanding of AD is shallow and largely attributes its causes to protein misfolding in the brain. This imposes several challenges on AD research. Longitudinal studies are time-consuming due to the low mortality rate of AD and metabolic processes are difficult to assess when hidden behind the blood-brain barrier. Ongoing research in other sectors revealed small extracellular vesicles to be of interest for many diseases. Additionally, high-throughput screening produced vast amounts of multi-omics data, which can train risk models that are highly tailored to individuals. We integrated extracellular vesicles and multi-omics data in training risk models to provide a new direction for AD research. The resulting risk models provided key biomarkers for further evaluations.

33. Presenter: Rubeena Gosal

“Do You See What I See? Relating MRI-based and Electron Microscopy-based Geometric Measurements of Tissue Structures within the Corpus Callosum”

Supervisor: Melanie Martin
Department: Physics
Category: Health Sciences

Abstract: Neurological diseases and disorders such as schizophrenia and Parkinson’s are thought to involve changes in the size and number of brain cells. A process of estimating these properties of brain cells using Magnetic Resonance imaging (MRI) is in development. MRI does not have the same precision and accuracy as the gold standard method, electron microscopy (EM), which requires tissue samples and the use of an electron microscope. The benefit of MRI is that it can be used before, during, and after diseases to gain a better understanding of the disease. The work presented here is a calibration of the MRI method using EM on the human corpus callosum.

34. Presenter: Princewill Jude-Ojei

“Synthesis of 3-(Diethylamino)-1-phenyl-1-propanone by Mannich reaction”

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

Abstract: The Mannich Reaction is a classical organic chemical reaction that is used in the synthesis of beta-amino carbonyl molecules, called Mannich bases. According to the accepted hypothesis of how this reaction occurs, a Bronsted-Lowry base, such as hydrochloric acid (HCl) is only required in catalytic amounts. However, when we attempted to modify a literature procedure for the production of 3-(diethylamino)-1-phenyl-1-propanone using acetophenone, diethylamine, and a catalytic amount of HCl, the reaction failed. We achieved production of the product in 26% yield when the amount of HCl was increased. Based upon our observations, we believe that the requirement for more HCl is a practical need to prevent the loss of volatile diethylamine from the reaction mixture.

35. Presenter: Modeste Katotoka

“Shim coils and their importance in measuring the neutron electric dipole moment (EDM) for the TUCAN EDM experiment.”

Supervisor: Jeff Martin
Department: Physics
Category: Experimental Physical Science

Abstract: Precise measurements of the neutron electric dipole moment (EDM) could result in a discovery of a violation of particle-antiparticle symmetry, and of new physics beyond the standard model. The TRIUMF Ultracold Advanced Neutron (TUCAN) collaboration is preparing an experiment to measure the neutron EDM with an accuracy of 1×10^{-27} ecm, a factor of 10 better than the world’s previous best, published in 2020. The shim coils are used to make the field inside the EDM measurement cells very homogeneous, $\sigma(B_z) < 40$ pT in field of $B_z = 1 \mu\text{T}$. I will present my design studies of a shim coil system for the TUCAN EDM experiment, which is based on square coils placed on the walls of the magnetically shielded room surrounding the EDM cells.

36. Presenter: Kyle Wittmeier

“Assessing Parameters of Single-Field Inflation Models on the Production of Primordial Black Holes as Dark Matter Candidates”

Supervisor: Evan McDonough
Department: Physics
Category: Mathematical & Theoretical Physical Sciences

Abstract: This research focuses on the evolution of density perturbations in the very early universe, which serve as the seeds for galaxies and large-scale cosmic structures, generated during ‘inflationary’ cosmological models. Given density perturbations have the potential to produce primordial black holes (PBHs) formation, a possible dark matter candidate. Utilizing the inflationary cosmological models, we investigate the extent of fine-tuning required for specific parameters for PBH production and to measure consistency with Cosmic Microwave Background (CMB) data, particularly the spectral index. Additionally, we introduce a spectator field to assess the robustness of these models under the influence of small alterations to field evolution. Our findings aim to provide deeper insights into the stability and reliability of inflationary scenarios in generating PBHs.

37. Presenter: Melody Hutton

“Effects of Elevated CO₂ on Brain mRNA in Japanese Medaka (Oryzias latipes)”

Supervisor: Caleb Hasler

Department: Biology

Category: Biological & Environmental Sciences

Abstract: As CO₂ levels rise, there is increased concern for fish health due to the stress of aquatic acidification which may reduce fitness through impaired predator evasion, vision, olfaction, and homing abilities. Investigating the impact of freshwater acidification on fish brains, I hypothesize that acidification will alter medaka (*Oryzias latipes*) relative brain mRNA abundance of genes used in ion and water transport, circadian rhythm, behaviour, and neurogenesis. *O. latipes* were exposed to 2500 μ atm or 8500 μ atm of CO₂ over 20 days. Whole brains were collected on days 0 (control), 5, 10, and 20 for mRNA analysis with qPCR. Preliminary brain qPCR results show few deviations from the norm under these pH levels. These results are important to understand the molecular-behavioural consequences of future freshwater acidification.

38. Presenter: Amy Pitzel

“Revealing evolutionary secrets: How are eliminated chromosomes involved in sexual development of an early vertebrate”

Supervisor: Sara Good

Department: Biology

Category: Biological & Environmental Sciences

Abstract: Lampreys are one of few vertebrate species that undergo programmed genome rearrangement involving the removal of 12 germline specific regions (GSRs). Germline specific genes (GSGs) harboured in this region are likely involved in the crucial processes of sex differentiation (SDD) and sex determination (SD). We aim to identify the temporal window during which SDD occurs and the genetic mechanisms controlling this process. Assuming females harbour the same GSR as males, epigenetic control of the GSR may be pivotal for SD and SDD processes. We hypothesize that GSGs exhibit life-stage specific expression that mirror gonadal histological changes associated with the progression of SDD. Additionally, differential methylation of SDD genes will occur in males and females. This research will provide insights into evolutionary genetics and strategies for managing invasive sea lamprey populations.

39. Presenter: Leena Tetrault

“Best Thing I Never Had”: Parasites in Coregonus artedii (cisco), Sander canadensis (sauger), and Catostomus commersonii (white sucker) from Manitoban lakes.”

Supervisor: Caleb Hasler

Department: Biology

Category: Biological & Environmental Sciences

Abstract: Fishing in Manitoba is crucial for food security, economic prosperity, and recreation however, parasites negatively impact this industry. Thus, understanding parasite impacts on fish health and human food systems is imperative. Parasites from sauger, cisco, and white sucker were isolated, preserved, stained, and identified. Then, pathogenicity and sequential impacts were investigated. The most prevalent parasites included *Camallanus* sp. in sauger, *Triaenophorus crassus* in cisco, and *Pomphorhynchus bulbocolli* in white sucker. Additionally, *Cotylurus communis* from white sucker poses a potential risk to humans, requiring further investigation as its congener, *Cotylurus japonicus*, is pathogenic to humans. Ultimately, parasites negatively effect fish by impacting ecosystems and causing physical damage and death. Furthermore, this affects humans as the nutritional value and accessibility to fish is impacted, leading to micronutrient deficiencies and food insecurity.