Conference Program

CARLETON UNDERGRADUATE
Journal of Science

I-CUREUS & SaPP Showcase

Carleton University

April 9, 2026
11:00 am – 2:00 pm

PROGRAM SCHEDULE

11:00 am	**Opening Remarks**
11:00 am – 2:00 pm	**Poster Session**

For any questions, please email:
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LETTER FROM THE CARLETON UNDERGRADUATE JOURNAL OF SCIENCE

This program showcases the diversity of research conducted in the Carleton community by students completing projects through the Internship – Carleton University Research Experience for Undergraduate Students (I-CUREUS) and the Students as Partners Program (SaPP). The projects being presented today serve to have substantial and tangible impacts on our society, such as by developing equity-informed understandings of leadership in nursing, creating a pan-Canadian electricity system model to enable a net-zero Canada, and understanding how colonialism and segregation shape urban forms. This program celebrates these incredible projects and the students' hard work over the past year. We are looking forward to seeing how students directly benefit from this work in the coming years.

The I-CUREUS and SaPP programs provide students with a unique opportunity to gain applied experience in research and course development, an opportunity that many students may not otherwise be able to access. Having completed a term in the SaPP in 2020, I can speak firsthand to the valuable working relationships, strong critical thinking and communication skills, and deep understanding of pedagogy that I developed. These skills have been indispensable to my academic journey, and I am incredibly grateful for the mentorship I received from my staff partners in completing my term. These programs are strong pillars of Carleton's community and I look forward to seeing them continue to grow in the coming years.

The Carleton Undergraduate Journal of Science was created to showcase the exceptional work of Carleton's undergraduate community and the students participating in today's showcase exemplify this mission. It has been a privilege to collaborate with Jill Goodkey, the Future Learning Lab Program Administrator, on this program.

For our readers, we hope that these projects leave you reinvigorated with academic curiosity, a drive for exploration, and a deeper understanding of the research of your peers. This issue is an invaluable opportunity to engage with research that is actively occurring in the Carleton community and to learn from other passionate researchers in your community!

Warmly,

Ellen Coady
Co-Editor-in-Chief
Carleton Undergraduate Journal of Science

Internship – Carleton University Research Experience for Undergraduate Students

COLONIAL CENTERS: A COMPARISON OF URBAN HISTORY IN TRIPOLI & LUANDA

Juwayriya Albatnuni, *Bachelor of Global and International Studies*
Supervisor: Dr. Candace Sobers

Embedded in its built environment and spatial organization, urbanization also reflects a city's historical memory. This paper examines how colonialism and segregation shaped urban form in Luanda, Angola, and Tripoli, Libya. It argues that urban space is not neutral but was deliberately structured to serve colonial expansion and prosperity.

Drawing on Anthony King's 'Dual City' model, the paper highlights how colonial planning institutionalized segregation between colonizers and Indigenous populations, producing long-term inequalities visible in slums and ghettos, often growing into sites of resistance. King's characterization of urban areas in colonial society is one of "physical segregation of its ethnic, social and cultural component groups, which resulted from the processes of colonialism" (King 1976, 17).

Beyond spatial division, the study explores how colonial powers used public space to construct nationalism and reinforce symbolic dominance, overshadowing Indigenous participation and undermining their Right to the City (Tomas 2022, 113). Through qualitative comparative analysis, it examines how differing colonial regimes across Africa generated distinct yet interconnected urban outcomes. While cross-African comparisons remain limited in academia, this approach is necessary for a more holistic understanding of the continent's history.

Despite declarations of independence, material legacies of colonialism persist, shaping citizens' everyday lives in ways that often go unnoticed. The multidisciplinary nature of this study bridges the gap between urban studies and settler colonial studies. This paper situates colonial power within the physical landscape, demonstrating how urban centers were, and continue to be, an integral tool to deepen their hold on the country and to mould a built environment that caters to their benefit.

FROM AUDIENCE TO AUTHORITY: TOWARD A CRITICAL CHILDREN'S MUSEOLOGY

Cydney Bradbury, *Bachelor of Childhood and Youth Studies*
Supervisor: Dr. Monica Patterson

This research contributes to the new field of Critical Children's Museology by exploring the ways children make a difference in museum spaces through case studies that place children as collaborators, creators, and curators of their own experiences and histories. Dr. Patterson describes children's museology as work produced not only for and about children but also by and with them as social actors and knowledge producers. This research proposes that the key issue here is not children's participation but their authority. This qualitative study analyzes museum and institution documents through a critical childhood studies framework with children's rights and Article 12 of the United Nations Convention on the Rights of the Child as guides. This analysis was conducted through Hart's Ladder of Participation and a Child Agency–Trust–Representation framework with four categories: public audience, consultant, co-creator, and sovereign actor. This study found that museums were working with an adult-centric understanding of children, placing them as visitors who were meant to be educated or entertained. Children were present as audiences and learners but were not present as interpreters, curators, and decision-makers. This finding points to the need for children's authority as high-agency contributors to meaning and memory beyond the idea of participation.

VIRTUAL REALITY FOR OLDER ADULTS: A MEDIA ANALYSIS USING THE ACCESS RAINBOW FRAMEWORK

Jayne Davies, *Bachelor of Information Technology*
Supervisor: Dr. Jaisie Sin

This study examines how virtual reality (VR) is portrayed and described as an implemented activity for older adults within public-facing media and literature, using the Access Rainbow Framework as an analytical lens. Media descriptions tend to prioritize devices and content/services, often highlighting head-mounted displays and engaging VR experiences, while carriage facilities (infrastructure) and governance/regulation are largely assumed or under reported. Service providers are typically represented through collaborations between care facilities, technology companies, and research institutions, though their roles are not always explicitly detailed. Notably, literacy and social facilitation emerge as critical factors, with low digital literacy and reliance on trained staff frequently identified as barriers to meaningful participation. Overall, the analysis demonstrates that while VR is presented as an accessible and beneficial activity for older adults, public-facing narratives often overlook many elements of the process. Using the Access Rainbow Framework, this study reveals inconsistencies between how VR is presented and the conditions required for its effective use, underscoring several key factors of the experience.

DYNAMIC TRAFFIC ASSIGNMENT, MODE CHOICE AND MODEL CALIBRATION

Arushi Dutta, *Bachelor of Engineering in Civil Engineering*
Supervisor: Dr. Adam Weiss

This research project focuses on the development and calibration of a microsimulation traffic model using PTV Vissim. The primary objective is to establish a comprehensive model of the transportation network in the City of Gatineau that replicates current traffic behaviour and can support future traffic analysis. Calibration of the model involves the input of current traffic data, including signal timings, stop sign placement, and design speed decisions across key intersections. Signal timing and intersection performance are given particular attention to improve the overall accuracy of the model.

This project is being conducted as part of a research service contract for Public Services and Procurement Canada (PSPC), which manages and operates the Alexandra Bridge, the Chaudière Crossing and Macdonald-Cartier Bridge. The calibrated model is intended to serve as a tool for evaluating various scenarios in the Ottawa-Gatineau region, such as lane closures on major bridges, bridge closures, and new bridge infrastructure.

TRACKING (IN)JUSTICE: TRACKING AND MAPPING POLICE-INVOLVED DEATHS IN CANADA

Melissa Elmas, *Honours Bachelor of Arts in Psychology*
Supervisor: Dr. Alexander McClelland

The Tracking (In)Justice database is a national, independent initiative that documents police-involved deaths in Canada from 2000 to the present. Drawing on publicly available sources, the database has identified 863 deaths resulting from police use of force since 2000. The project is currently developing an interactive map to geographically pinpoint these incidents.

Cases prior to June 1, 2020, are sourced from the Canadian Broadcasting Corporation's Deadly Force Database, which lacked location information beyond the province of the incident. To address these gaps, additional data were collected using key identifiers such as the victim's name, age, date of incident, province, and police service. These identifiers were used to gain further information from publicly available sources such as accredited media sources, public inquiries, and government reports. This experience also involved ongoing contribution to the database through identifying new cases of police-involved deaths. Between January and February 2026, seven deaths resulting from police use of force was recorded. New cases were identified through systematic online searches with necessary variable information added to the dataset's spreadsheet. Each case was verified by a second member of the team before being finalized and added to the website.

VISUALIZING MULTIPLE CAUSE MORTALITY

Ella Fracker, *Honours Bachelor of Health Sciences*
Supervisor: Dr. Paul Peters

This project explores how different weighting methods affect the measurement of age-standardized mortality rates (ASMR) in Canada. Using national mortality data from 2018 to 2021, I compared multiple approaches, including unweighted data and three alternative weighting methods that distribute importance across multiple contributing causes of death. The data was cleaned and transformed using R, and interactive visualizations were created using *ggplot2* and *Shiny* to compare trends across causes of death, sex, and time. By examining differences between weighting methods, the project demonstrates how methodological choices can influence the interpretation of mortality patterns. The findings show that while general trends remain consistent, the size and importance of certain causes of death can vary depending on the weighting approach used. This finding reflects the idea that health outcomes may be more complex than they initially appear, and it has implications for how mortality data are analyzed and interpreted in public health research and policy.

CONSOLIDATING RENEWABLE AND TRANSMISSION EXPANSION DATA TO ENABLE A NET-ZERO CANADA

Pine Kearns, *Bachelor of Engineering in Sustainable and Renewable Energy Engineering*
Supervisor: Dr. Ahmed Abdulla

The global energy system is responsible for most anthropogenic greenhouse gas emissions (~75%) and converting it to cleaner sources of energy—especially electricity derived from low-carbon resources—is key to avoiding the most devastating consequences of climate change. Countries, including Canada, are pursuing net-zero emission targets, often to be achieved by the year 2050, and many are expanding their clean energy generation and transmission capacities to achieve these targets. In Canada, one challenge to energy transition is that energy and environmental matters are the responsibility of sub-national entities, the provinces, and each has a different approach to coordinating the move to cleaner energy sources. Some provinces have more developed plans than others, and in most there are no readily available data for analysts to examine and support energy system planning. This project involved collecting, organizing, and analysing data from disparate sources and in disparate formats across Canadian provinces in order to ready them for integration into a pan-Canadian electricity system model that will inform future grid planning activities.

INCORPORATING INDIGENOUS CONTENT INTO STEM UNDERGRADUATE COURSES

Samuel Mallow, *Bachelor of Science in Neuroscience and Mental Health*
Supervisor: Dr. Martha Mullally

Our project examines the integration of Indigenous learning into undergraduate STEM education through the use of Carleton Indigenous Learning Bundles (CILBs) in science courses. The Truth and Reconciliation Commission's Calls to Action urge universities to incorporate Indigenous ways of knowing into curriculum, a task that poses unique challenges in STEM fields rooted in objectivity and quantifiable phenomena. CILBs offer a meaningful entry point for Indigenous perspectives within these disciplines, allowing students to engage with multiple knowledge systems and deepen their understanding of scientific concepts. However, limited science-related bundles and the discomfort some non-Indigenous instructors feel when presenting Indigenous Knowledge as equal to Western frameworks have slowed their adoption. Through interviews with professors, we identified barriers and successful strategies for CILB implementation, informing the development of a practical toolkit for instructors. This toolkit outlines steps to access, prepare, plan, and apply a bundle, and includes resources on ethical research, innovative teaching practices, and global initiatives interweaving Indigenous and Western sciences. By supporting instructors in this process, our project fosters more inclusive, reciprocal, and transformative approaches to STEM education that include Indigenous Knowledge.

PERFORMANCE-BASED FIRE SAFETY FRAMEWORK FOR THE GLANMORE NATIONAL HISTORIC SITE

Eugene Matsiyevsky, *Bachelor of Engineering in Civil Engineering*
Supervisor: Dr. Mohamed Beshir

The Glanmore National Historic Site (GNHS) is a designated National Historic Site of Canada and an active public museum housed within a late 19th-century heritage building. Due to its combustible construction, limited compartmentation, and absence of automatic fire suppression, the building presents fire safety challenges that cannot be adequately addressed through prescriptive code approaches alone. A risk-informed, scenario based methodology was adopted, considering building characteristics, occupant behaviour, and emergency response conditions. Fire and evacuation simulations were conducted to evaluate the tenability, evacuation performance, and safety margins for different fire scenarios. The simulations were performed for baseline conditions and possible protection strategies, including implementation of downstands and automatic sprinkler systems. The results demonstrate that these fire protection measures have a significant influence on improving evacuation safety for occupants.

VISUALIZING THE PRINCIPLE OF LEAST ACTION

Ciaran McDonald-Jensen, *Bachelor of Engineering in Engineering Physics*
Supervisor: Dr. Daniel Stolarski

The principle of least action is a guiding concept in fundamental physics with prominent appearances in many fields including classical mechanics, general relativity, and quantum mechanics. The theory examines all the possible paths that an object could take to get from point 'A' to point 'B'. It states that the object will take the route that minimizes the 'action' of the path—relating to the object's energy over time. This concept is often not intuitive and is known to be challenging for students at the upper undergraduate level. To address this difficulty, this work explores the intuitively simple one-dimensional spring system and computes the 'action' for a variety of paths, creating visualizations that will give the reader a deeper understanding of the principle of least action. These visualizations provide an accessible entry point to the principle of least action and facilitate its understanding in educational contexts.

EFFECT OF TISSUE-REINFORCING HYDROGEL IN THE COMPOSITION AND STRUCTURE OF ARTICULAR CARTILAGE

Imshaad Naaz, *Bachelor of Engineering in Biomedical & Electrical Engineering*
Supervisor: Dr. Eng Kuan Moo

Articular cartilage is a specialized connective tissue that provides load-bearing support and low-friction articulation in synovial joints. Degeneration of cartilage, as observed in osteoarthritis, leads to the loss of key extracellular matrix components such as proteoglycans and collagen, resulting in impaired mechanical function and joint pain. This study investigates the potential of a tissue-reinforcing hyaluronic acid (HA)-based hydrogel to restore the composition and structural organization of degraded articular cartilage.

Histological sections were obtained from porcine articular cartilage samples, which were subjected to either saline (control) or hydrogel treatment. Multi-modal imaging techniques were used to assess tissue composition and structure, including densitometry to quantify proteoglycan content and polarized light microscopy (PLM) to evaluate collagen organization and depth-dependent anisotropy. Image processing and quantitative analysis were performed using ImageJ and custom-developed MATLAB and Python scripts to extract normalized one-dimensional profiles across the cartilage thickness.

Comparisons were conducted across treatment groups (control, control + hydrogel, digested, and digested + hydrogel) as a function of normalized tissue depth. These analyses provide insight into spatial variations in extracellular matrix composition and structural integrity following hydrogel treatment. The findings contribute to evaluating the effectiveness of HA-based hydrogels as a therapeutic strategy for cartilage repair and regeneration.

THE COMPOSITE CROSS-LAYER BACKDOOR: GAN-ENABLED DATA POISONING AND DUAL-LAYER DEFENSES IN 6G O-RAN

Nolan Nayel, *Bachelor of Engineering in Computer Systems Engineering*
Supervisor: Dr. Halim Yanikomeroglu

Emerging 6G Open Radio Access Networks (O-RAN) increasingly rely on reinforcement learning (RL) agents for dynamic resource optimization. However, the dependency of these AI-native controllers on massive offline training datasets exposes the machine learning supply chain to critical data poisoning vulnerabilities. In this project, we introduce a novel, highly stealthy composite backdoor attack spanning multiple network layers. Unlike traditional methods that rely on statistically anomalous outliers, we deploy a generative adversarial network (GAN) to synthesize latent trigger states distributed across the physical (PHY) and medium access control (MAC) layers. Because these triggers are mathematically indistinguishable from benign network traffic fluctuations, they easily bypass statistical anomaly detection. By injecting these generated states into the training pipeline, adversaries covertly manipulate the RL agent to execute destructive actions, such as severe throughput degradation, when the specific network state is spoofed during live operations. We quantify the efficacy and stealth of this evasion tactic using a Poison Stealth vs. Attack Amplification Factor (psAAF) metric. To neutralize this advanced threat, we propose a dual-layer defense framework grounded in physical network constraints. The primary layer, the causal cross-layer consistency defense (C3D), functions as a deterministic verification oracle that evaluates RL outputs against expected performance boundaries to block malicious actions before execution. The secondary layer, the reward consistency routine (RCR), reinforces this passive filtering by actively injecting controlled network perturbations to verify environment integrity and detect telemetry spoofing. Extensive evaluations within a rigorous asynchronous ns-3 simulation demonstrate that our framework effectively identifies and mitigates synthetic supply chain backdoors, establishing a verifiable security paradigm for autonomous cyber-physical systems.

IMPLEMENTING A LOCAL PIPELINE TO MEASURE WHITE MATTER HYPERINTENSITIES IN ALZHEIMER'S

Laila Rashad, *Bachelor of Science in Neuroscience & Biology*
Supervisor: Dr. Reggie Taylor

Throughout Winter 2026, a literature search was conducted to find a pipeline that is commonly used and could be implemented locally to assess white matter hyperintensities in the brain. This pipeline is to be used in a study being done on Alzheimer's disease patients to examine the correlation between white matter hyperintensities and Alzheimer's disease. PubMed was the primary database used to identify relevant neuroimaging studies. The most common ways to image and study white matter hyperintensities include using MRI imaging techniques, including T1 and T2 weighted imaging. A number of research groups were found to use variations of the Free surfer pipeline for structural analysis of the brain. Among the pipelines reviewed, the UBO detector was identified as a promising and accessible tool for automated white matter hyperintensity detection.

FAT CHAIR

Brett Rawlek, *Bachelor of Industrial Design*
Supervisor: Dr. Fady Shanouda

The portion of the project that I will be presenting is a taxonomy of chairs from around the world from different periods to analyse the development of chairs alongside societies, the influences imposed on their design from such societies, and the implications that follow due to these designs. For example, in a modern context, industrialization and profit motivations exclude fat individuals in chair design.

SOLENOID-ACTUATED DRUM DEVICE FOR ACCESSIBLE MUSIC INTERACTION

Dhanya Saravanan, *Bachelor of Engineering in Biomedical and Mechanical Engineering*
Supervisor: Dr. James Green & Dr. Adrian Chan

In recent years, there have been increasing efforts to develop inclusive and adaptive musical instruments that assist individuals with diverse abilities in producing music. Current solutions make use of various input sensors that work alongside digital music software. However, these solutions can lack tangible interaction, limiting physical feedback and lessening user engagement and intuitiveness. To address this, this project focused on the development of a portable, solenoid-actuated drumming device that produced music purely through physical interactions with minimal user effort. The current prototype is controlled via capacitive touch sensors. These sensors enable users to control the device with simple touch-based input. The touch sensors communicate wirelessly to the device and activate a mechanism built around a mini solenoid that enables the mallet to strike the object. By incorporating primarily physical components, the system provides both auditory and visual feedback, enhancing the user experience through tangible interaction. The overall system is designed to be portable, easy to operate, and adaptable to various environments, including rehabilitation settings. Overall, this work explores how combining simple input methods with physical output can support more accessible and engaging music-making experiences.

CODING THE CUES: A QUALITATIVE ANALYSIS OF IMPRESSIONS AND META-PERCEPTIONS OF PERSONALITY

Nadira Sharif, *Honours Bachelor of Science in Psychology*
Supervisor: Dr. Norhan Elsaadawy

How do people form perceptions of themselves and others? This project explored the sources of information people use to form impressions (i.e., personality judgements about others) and meta-perceptions (i.e., beliefs about how others perceive them). Top-down and bottom-up approaches were used to identify common cues participants referenced when describing impressions of others and meta-perceptions. Impression sources fell into three domains: behavioural information, physical appearance, and other sources (e.g., global positivity). Meta-perception sources fell into four domains: self-observation of behaviour, self-perception of personality, feedback, and other sources (e.g.., global relationship sentiment). Using this coding scheme, the impressions and meta-perceptions of 150 friend dyads were coded. Results indicated that the participants relied mainly on direct behavioural information (93.3%) when forming personality judgements about others. Indirect behavioural sources were used less frequently (13.4%), followed by other sources (9.4%), and appearance-based cues (1.3%). For meta-perceptions, participants predominantly used self-observation of behaviour (80.4%). Feedback was used less frequently (28.4%), followed by self-perception of personality (25.7%), and other sources (18.2%). Overall, individuals focus on their friends' behaviours when forming impressions and observe their own behaviour when forming meta-perceptions. This finding suggests that individuals may recognize their own behaviour as the source of information others use to evaluate them, highlighting behaviour as the primary cue in forming personality judgements.

LOW-COST BIOMEDICAL ENGINEERING TEACHING KITS

Samuel Smith, *Bachelor of Engineering in Biomedical and Mechanical Engineering*
Supervisor: Dr. Andrew Harris

My goal is to develop a set of small, low-cost devices that can be used as educational tools in high schools, at summer camps, museums, and in remote communities in Canada. These devices will engage students in exciting and informative experiments that can promote curiosity and interest in studying physics, engineering, and interdisciplinary programs such as biomedical engineering.

My focus is to develop three biomedical engineering devices that are low-cost, easy to manufacture, easy to use, and interactive for pre-university students. The first of these devices will be a 3D printed microscope. This device will enable students to be able to visualize the movement of fluid as micro-organisms swim through water and thus combines concepts from fluid mechanics (engineering) and microbiology. The microscope will also allow for students to remove doors and compartments to learn about the inner workings of the microscope and the engineering design principles on which it is made. The second device will be a low-cost materials testing system. This device will enable students to measure the strength and stiffness of different samples. By comparing the stiffness of soft samples, such as gelatin, vs. stiff samples, such as plastics, students will learn concepts from materials engineering and how the physical properties of the tissues in our body are important for their function. The final device will be a soft robot gripper designed to mimic the mechanisms by which an octopus grips objects. This device will educate students in concepts from bio-inspired design and robotics engineering.

The three devices will be made at low-cost using 3D printing and readily accessible components, with a total target cost of less than $100CAD. They will be integrated in a small (table-top) portable format so that they can be easily deployed and only rely on readily accessible consumables for the experiments. The combination of these three small devices will equip classrooms, summer camps, museums and communities with cheap, yet exciting and interactive, experiments. Towards this end, we have already engaged the Canada Science and Technology Museum – Ingenium, who have expressed an interest in using these devices in their workshops and potentially as an exhibit.

WORK-ZONE SAFETY ANALYSIS IN CANADA: STATE OF KNOWLEDGE AND PILOT EXPERIMENTAL STUDY

Evelyn Vanderstarre, *Bachelor of Engineering in Civil Engineering*
Supervisor: Dr. Karim Ismail

This research study aimed to assess the viability of leveraging vehicle-to-infrastructure communications and connected sensors to provide real-time protection for workers and vulnerable road users in work zones. To achieve this, a literature review was conducted to address five main points: risk factors affecting Work-Zone Safety (WZS), predictive and analytical models, technologies used to improve WZS, work zone evaluation approaches, and connected vehicle technologies and ITS integration. The review identified that work zones have increased crash risk from motorists due to increased distractions, previous WZS studies have employed various predictive models, and various methods have been used to evaluate WZS. A key consideration in this report was accessibility for readers to locate, identify, and operate Information and Communication Technology (ICT) functions. Especially to access the information provided, regardless of physical, cognitive, or sensory abilities. To accomplish this, guidelines from the Accessibility Requirements for ICT Products and Services document were used, which discussed requirements for various ICT solutions. The most fundamental chapter for improving the accessibility of the report was Clause 10: Non-web documents, which focused on topics including text contrast, alt-texts, and implementation of shape and colour.

ANALYSIS OF PHYSIOLOGICAL SIGNALS FOR EXAM STRESS MONITORING

Valerie Xie, *Bachelor of Engineering in Biomedical and Mechanical Engineering*
Supervisor: Dr. Andy Adler

Exam-related stress can significantly impact physiological state, motivating the need for objective, data-driven monitoring methods. This study presents a physiological signal processing and analysis framework for exam stress monitoring using electrocardiography (ECG), bioimpedance (BIOZ), photoplethysmography (PPG), and inertial measurement unit (IMU) data collected during controlled experimental conditions. Data acquisition was performed using a custom integrated sensing instrument designed to capture synchronized physiological signals in a realistic testing environment. Volunteers underwent a series of conditions, including baseline measurements during relaxed states, followed by low-stress tasks, and progressively more physically demanding scenarios to elicit varying stress responses. Raw signals were preprocessed using frequency-domain filtering techniques to reduce noise and isolate relevant physiological components. Signal streams with differing sampling rates were synchronized to enable consistent temporal alignment and comparison. Key features associated with stress responses were extracted and visualized through an interactive plotting interface, supporting detailed inspection of temporal patterns and event-specific variations. The system also incorporates an annotation workflow to label segments of interest, facilitating structured analysis and interpretation of physiological responses. Preliminary observations demonstrate distinguishable patterns in cardiovascular and motion-related signals corresponding to varying stress levels, highlighting the potential of physiological signal analysis for improved stress assessment. This work establishes a scalable and flexible framework for physiological signal analysis, with applications in stress monitoring, behavioral studies, and real-time biofeedback systems.

Students as Partners Program

GENOME EDITING OF THE CAN1 GENE WITH CRISPR/CAS9 TO GENERATE FRAMESHIFT MUTATIONS IN SACCHAROMYCES CEREVISIAE

Janice Corbette, *Bachelor of Science in Biology*
Staff Partner: Mihaela Flueraru

CRISPR/Cas9 genome editing is a foundational technology in modern biology; however, many opportunities for undergraduate students to gain hands-on experience with this method remain limited by cost and technical complexity. This project focuses on developing a multi-week laboratory module for *BIOL 4109* (Laboratory Techniques in Molecular Genetics) that gives students hands-on experience with CRISPR/Cas9 using the model organism *Saccharomyces cerevisiae*.

In this module, the CAN1 gene was targeted using a Cas9 and single guide RNA (sgRNA) system to generate loss-of-function mutations. Cas9-induced double-strand breaks were repaired primarily through non-homologous end joining, resulting in insertion or deletion mutations that disrupt gene function. Edited cells were selected using canavanine-containing plates, as disruption of CAN1, which encodes an arginine permease, grants resistance to the toxic arginine analog. Students then isolated genomic DNA, amplified the target region by PCR, and prepared samples for sequencing to confirm gene editing outcomes.

This module was designed to help students not only understand key concepts in molecular biology, but also build confidence with the techniques used in the lab. Overall, it provides a cost-effective and scalable approach to integrating CRISPR/Cas9 into undergraduate classrooms, bridging the gap between theoretical knowledge and practical application.

MAP2: THE DEVELOPMENT OF NEW NEUROANATOMY LABORATORY COURSE MATERIALS

Sophia Goudreau, *Honours Bachelor of Science in Biology & Neuroscience*
Staff Partner: Lindsay Hyland

Advanced neuroanatomy laboratories prepare undergraduate students for postgraduate research programs by helping them to refine their knowledge and skills. In this project, we tested new antibody concentrations to develop course materials for the advanced neuroanatomy lab. The MAP2 stain binds to microtubule-associated protein 2, enabling us to visualize neuronal cytoskeletal proteins known as microtubules. We sectioned and stained rat brains for MAP2, then mounted these sections on slides to create a long-term tissue bank of MAP2 distribution throughout the brain. This resource plays a critical role in the neuroanatomy laboratory course, as it allows future students to visualize neuronal projections within the central nervous system. By observing the arborizations of neurons, students develop a stronger understanding of neuronal communication in the brain, leading to a deeper comprehension of neurological systems.

DEVELOPING ORAL ADVOCACY SKILLS IN UNDERGRADUATE LEGAL EDUCATION

Nikki Liu, *Honours Bachelor of Arts in Law*
Staff Partner: Steve Tasson and Vincent Kazmierski (S.J.D)

This project explores the role of oral advocacy in undergraduate legal education through the development of a proposed course, "Oral Advocacy" (*LAWS 3903* – Selected Topics in Legal Studies). The course is designed to strengthen students' oral communication and argumentation skills through practical exercises such as mooting, debates, and presentations. In addition to skills development, the project examines the historical and contemporary importance of oral advocacy within common law systems. By integrating both theoretical and experiential learning, the course aims to better prepare students for legal practice and other professional contexts requiring persuasive communication.

FUTURE FORWARD: TEACHING VIDEO STORYTELLING WITH EYES ON THE HORIZON

Josefine Lukaszek, *Bachelor of Journalism*
Staff Partner: Dr. Kanina Holmes

Dramatic shifts in how people consume, subscribe, produce, or abstain from journalism profoundly affect the field, profession and craft of journalism. The roles and responsibilities of truth seekers, storytellers, and trusted conduits for information, context and analysis—the work of journalists—becomes ever more critical in contributing to public discourse.

Many media scholars and industry analysts predict that consumption of social video—already on the rise—will play a pivotal role in how (or if) audiences will interact with news media and the fact-based information and insights they provide. In an attention economy, journalists currently compete with influencers, algorithms and, increasingly, synthetic media, and these developments prompt questions about how journalists produce, shape, and distribute video-centric stories.

This research seeks to understand how Carleton University's journalism curriculum prepares students to enter the field as (video) journalists, working with both established and emerging media. We compare the current video journalism curriculum at Carleton with offerings at other universities and colleges in Canada, the U.S. and Europe. We evaluate a range of approaches and pedagogies in video journalism, film and content creation programs. Additionally, we survey journalism job postings to identify current "must-sees" and skills in video expected from new and recent graduates. Finally, we interviewed journalism students in Europe and Canada to learn more about what they found effective and helpful about their program(s) in preparing them for their work upon graduation.

DESIGNING BETTER LABS, TOGETHER: A STUDENT-FACULTY PARTNERSHIP TO ENHANCE EXPERIENTIAL LEARNING OF RESEARCH SKILLS IN HEALTH PSYCHOLOGY

Katelyn Martin, *Honours Bachelor of Arts in Psychology*
Staff Partner: Dr. Rachel Burns

This project redesigned the lab component of *PSYC 3300* (Honours Seminar in Health Psychology), a foundational year-long course that prepares third-year undergraduate students for capstone research projects. The lab provides experiential learning activities which guide students through the complete research process: from developing research questions to analyzing data and presenting findings. Through this partnership, we reviewed and redesigned lab activities and materials using evidence-based pedagogical strategies to enhance cumulative skill development, engagement, and accessibility. As a recent student in the course and current Honours Thesis researcher, I contributed critical insight into student needs and learning barriers while gaining hands-on experience in curriculum design and academic collaboration. Key improvements included integrating scaffolded assessments with formative feedback opportunities, enhancing visual accessibility of teaching materials, developing case-based in-lab learning activities, creating comprehensive SPSS troubleshooting resources and Teaching Assistant guides, and reorganizing lab content sequencing for more logical skill progression. This partnership exemplifies reciprocal learning: I gained valuable transferable skills in pedagogical strategy and course design, while Dr. Burns benefitted from my student-centered perspective to create more responsive lab activities that better support future students' research competency development.

THE METACOGNITIVE BIOTECH CAREER CYCLE: MOVING FROM CONFUSION TO CLARITY

Anne Kathleen Melanson, *Bachelor of Health Sciences*
Staff Partner: Dr. Kama Szereszewski

Traditional undergraduate science curricula excel at teaching technical content, but often leave out a "hidden curriculum" regarding the diverse professional landscape of the biotechnology industry. Most students graduate with a narrow understanding of career trajectories, typically limited to academia, medicine, or government, resulting in significant anxiety and a lack of "industry literacy". To bridge this gap, this project developed a structured, student-led framework to transform professional exploration from a static list of companies into an active, iterative scientific process. At the core of this project is a 5-Stage Metacognitive Cycle designed to help students navigate the biotech ecosystem:

1. *Explore:* Investigating biotech sectors, identifying campus labs, and researching current hurdles in technology development.
2. *Test the Waters:* Identifying specific technical connections, including professors, founders, and industry researchers.
3. *Reach Out:* Conducting informational interviews and tracking the evolution of firms via professional networks.
4. *Come Back:* Reflecting on technical or business challenges discovered during outreach to shape the next iteration.
5. *Self-Discovery:* Synthesizing these insights to align personal scientific interests with industry needs and refining professional identity.

By embedding this iterative cycle into the Master of Biotechnology program, we move students from passive observers to active agents. This student-validated approach provides a replicable model for transforming scientific curiosity into professional direction, ensuring graduates are equipped to navigate the complexities of the global biotech industry.

DEVELOPMENT OF A BIOMEDICAL ENGINEERING COURSE: INTEGRATING COURSE OBJECTIVES, LABORATORY FEASIBILITY AND STUDENT PATHWAYS

Hayley Murray, *Bachelor of Engineering in Biomedical and Electrical Engineering*
Staff Partner: Dr. Andrew Harris

This project focuses on the development of a second-year biomedical engineering course designed to provide students with information regarding possible career pathways while contributing foundational knowledge to complement subsequent biomedical courses. Avenues of approach included the development of course lectures, investigation into laboratory costs and feasibility for two new labs, and potential assignment delivery methods.

This project resulted in two completed course lectures, laboratory posters and options for assignment implementation. Additionally, it resulted in the development of an exhaustive equipment list for two new labs, a standardized procedure for the cell lab, and cost analyses for both the cell and muscle laboratory. A pilot cell processing laboratory session with 10 students was completed successfully and provided valuable insight into possible improvements.

RE-IMAGINING AEROSPACE GRAPHICAL DESIGN

Zachary Myers, *Bachelor of Engineering in Aerospace Engineering*
Staff Partner: Dr. Henry Saari

This project aims to re-imagine and modernize the learning materials for *AERO 2001*: Aerospace Graphical Design. As it stands, the bulk of the learning material in the course is relatively unchanged from when it was developed in the year 2001. The primary goal is to enhance student engagement and comprehension by developing new suite learning resources, including updated labs and projects, and exposing students to exciting and engaging aerospace engineering material earlier in their programs. The scope involves a comprehensive review of the current course materials, followed by the co-design and creation of new content.

CRITICAL RACE FUTURISM

Elizabeth Neufeld, *Bachelor of Arts in Women and Gender Studies*
Staff Partner: Dr. Manjeet Birk

Through creating promotional materials for the Critical Race Studies program, our postcard supports critical thinking about the theoretical and practical applications of Critical Race in the academic environment. The focus of the project was on communications, marketing, curriculum development, recruitment, retention, and anti-oppression. Our aim of fantastical portraits was to decolonize critical based arts pedagogies and focus on Critical Race Futurisms.

LEADING BY EXAMPLE: ILLUSTRATING RESEARCH METHODS IN PSYCHOLOGY WITH FACULTY RESEARCH

Claire Palys, *Honours Bachelor of Science in Psychology*
Staff Partner: Dr. Kevin Nunes

I collaborated with Dr. Nunes to improve the Introduction to Research Methods in Psychology course (*PSYC 2001*) by more effectively preparing undergraduate psychology students to critically consume and produce research. I read the course textbook and 33 research articles by Carleton professors in the Department of Psychology. For each article, I evaluated its suitability for second-year students, identified key concepts and methodologies that were illustrated, and related them to the relevant textbook chapters. Dr. Nunes will assign the most suitable and exemplary articles for guided reading in class. It is hoped that guided readings of these articles will increase comfort with reading research articles, introduce them to interpreting and evaluating research evidence, familiarize them with the work professors in different areas of psychology are doing at Carleton, and illustrate key research methods concepts covered in the course. My SaPP project provided novel and engaging learning material for the *PSYC 2001* course and reinforced my own research methods knowledge.

DEFINING HEALTHCARE LEADERSHIP THROUGH AN EQUITY LENS: A STUDENT-FACULTY PARTNERSHIP IN HEALTHCARE SIMULATION-BASED EDUCATION

Alyssa Wong Guitard, *Honours Bachelor of Arts in Psychology*
Staff Partner: Jennifer Dale-Tam, RN

Background: This project was completed during the Winter semester of 2026. Nurses, particularly new graduate nurses, experience challenges in taking leadership positions and are often subjected to toxic leadership styles, resulting in "silence". There is a gap in literature defining leadership through a health equity, diversity and inclusivity (EDI) lens.

Purpose: Create a definition of healthcare leadership through an EDI lens to guide creation of three future simulation scenarios.

Methods: Guided by Kern's curriculum development cycle, a general literature review consisting of 28 papers was conducted to identify common leadership themes and gaps in healthcare, with a focus on nursing. Competencies from two professional nursing associations that aligned with the research question were mapped to the themes identified from the literature review. The student partner observed the current cohort of nursing students at the School of Nursing Skills and Simulation Centre to gain an understanding of simulation-based education. The student partner and faculty co-facilitated a focus group of nursing students to gain insight on their perceptions of leadership.

Results: Numerous identified traits, behaviors, beliefs and competencies guided the final definition. The definition of healthcare leadership through an EDI lens was created and will guide development of 3 simulation scenarios in the School of Nursing curriculum.

Conclusion: This work established a clear equity informed leadership definition that will directly shape future simulation design and strengthen leadership learning for nursing students.

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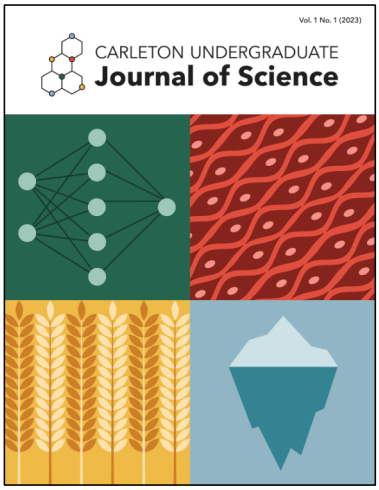

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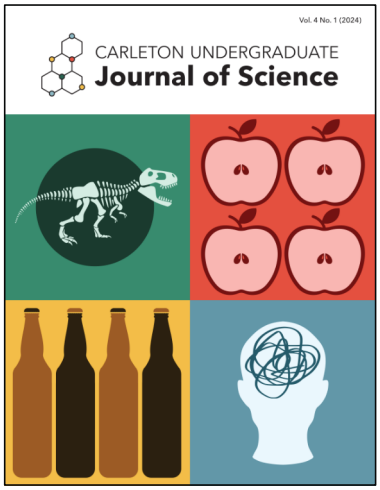

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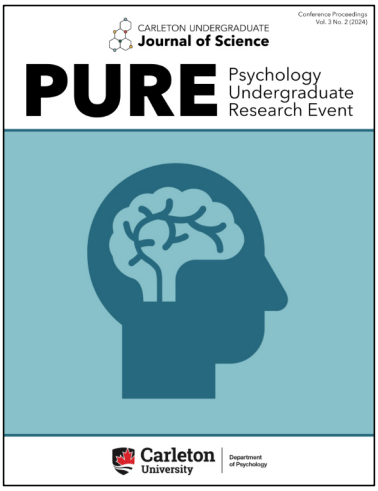

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