50 1971-2021 YEARS

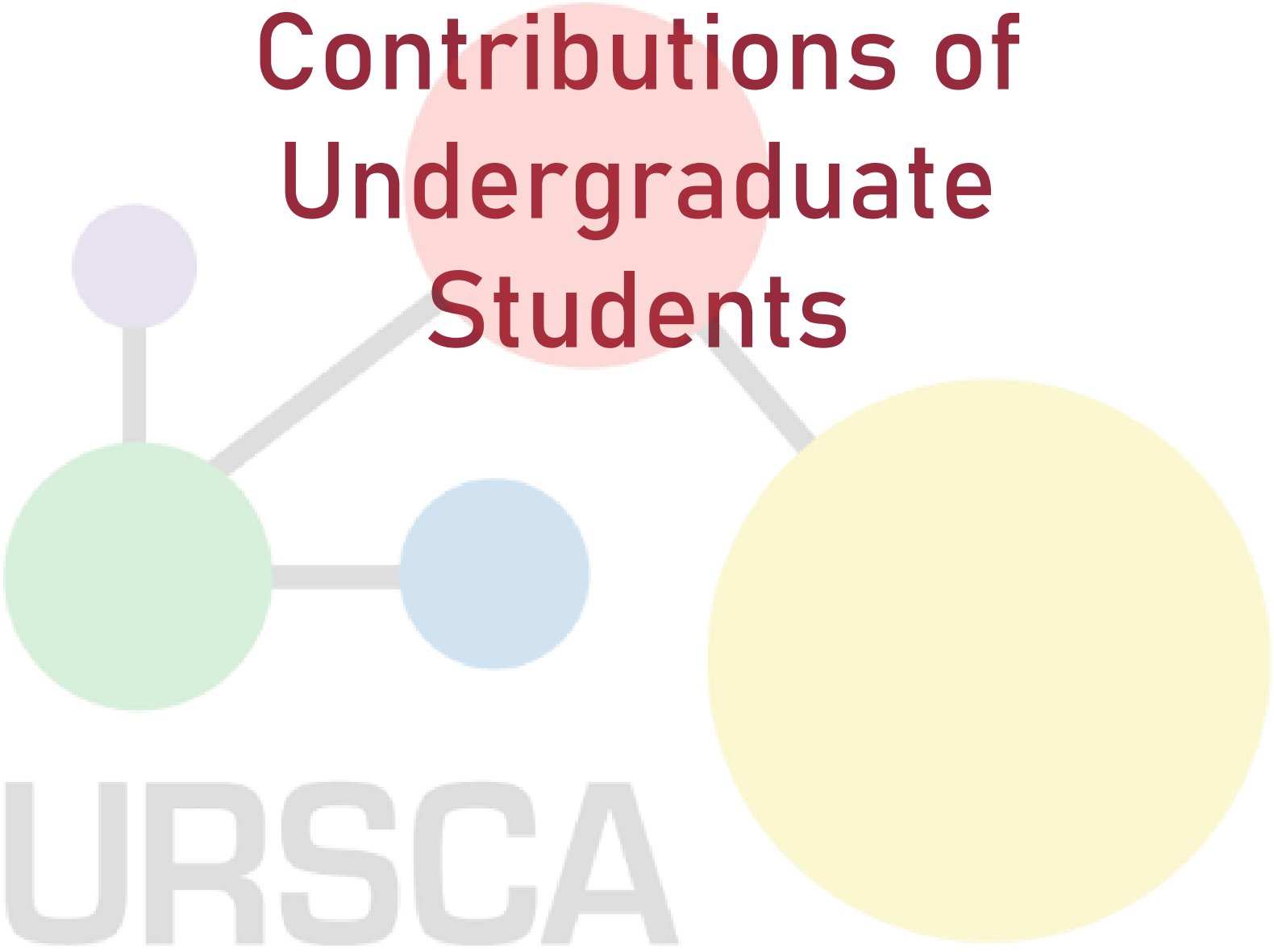
MacEwan UNIVERSITY

8th Annual Undergraduate Research in Science Conference of Alberta

URSCA

Virtual Conference May 5-6, 2022

Celebrating the Diverse Research Contributions of Undergraduate Students



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Introduction to URSCA

Welcome to the 8th annual undergraduate research in science conference of Alberta – or URSCA! Due to the uncertainty surrounding the Covid-19 pandemic, the conference is being held virtually, from May 5th to 6th, 2022, and is hosted by MacEwan University.

URSCA has been an instrument for the dissemination of undergraduate research since 2015, where the inaugural meeting was hosted by MacEwan university. Since then, URSCA has been hosted in person by King's University (2016), Mount Royal University (2017), University of Lethbridge (2018), and University of Calgary (2019) and online by the University of Lethbridge (2020) and Concordia University of Edmonton (2021).

Photo on left: Oral presentation from the inaugural URSCA meeting at MacEwan University in 2015. Photo courtesy of Dr Orla Aaquist.

Photo below: Reception for URSCA 2018 hosted by the university of Lethbridge. Photo courtesy of Dr Orla Aaquist.

Research is how science, and effectively our society, advances. The dissemination of research is crucial to scientific progress and URSCA is an important way for undergraduate students to make their first contributions. It is a place to share with their peers and the scientific community the ups and downs of their research rollercoaster. This process contributes to the growth of scientific knowledge conducted by a diverse group of undergraduate researchers. This year's theme is **Celebrating the Diverse Research Contributions of Undergraduate Students**. We look forward to meeting everyone online and learning about the incredible things you've been investigating!

Celebrating MacEwan's 50TH Anniversary

I would like to welcome everyone to MacEwan University and the Undergraduate Research in Science Conference of Alberta. We are very proud to be hosting this conference.

I want to start by congratulating all the students participating in this conference. Research is about being curious about a problem or opportunity and, by using your curiosity to engage in a research project, you have developed new skills and created new knowledge for the betterment of society. These skills will afford you opportunities going forward and will benefit you greatly in the years to come.

STEM research is a core part of our research ecosystem and can make several societal impacts including disciplinary, cultural, social, economic and policy. I appreciate this year's theme and its focus on the diverse research accomplishments of undergraduate students and how collaborative science is crucial for solving global problems. Today's local and global challenges are complex and interdisciplinary. Research is necessary to understand and manage these problems. STEM disciplines have much to offer in our

pursuit of interdisciplinary scholarship and knowledge.

MacEwan University is currently celebrating our 50th Anniversary. Undergraduate research is a key part of our new institutional strategic vision. MacEwan University's research ecosystem has evolved substantially in recent years as evidenced by our increase in external research funding, such as from NSERC, and the recent opening of our new Zebrafish lab. We have also seen an increase in the breadth and depth of STEM research done at MacEwan. All of these accomplishments create a vibrant atmosphere for STEM research that enables faculty members to effectively engage students.

URSCA provides a wonderful opportunity to keep moving the needle on undergraduate research. It allows the next generation of scientists, educators, and practitioners an opportunity to meet, connect with and present to their peers, as well as the opportunity to gain valuable experience as a conference presenter. I hope everyone takes the opportunity to reconnect with existing colleagues but also to build new friendships and research networks.

In closing, I offer my congratulations to the students who will be presenting, and my profound thanks to the faculty members who mentored and inspired the students. Remember - no one succeeds alone.

I wish everyone a productive conference.

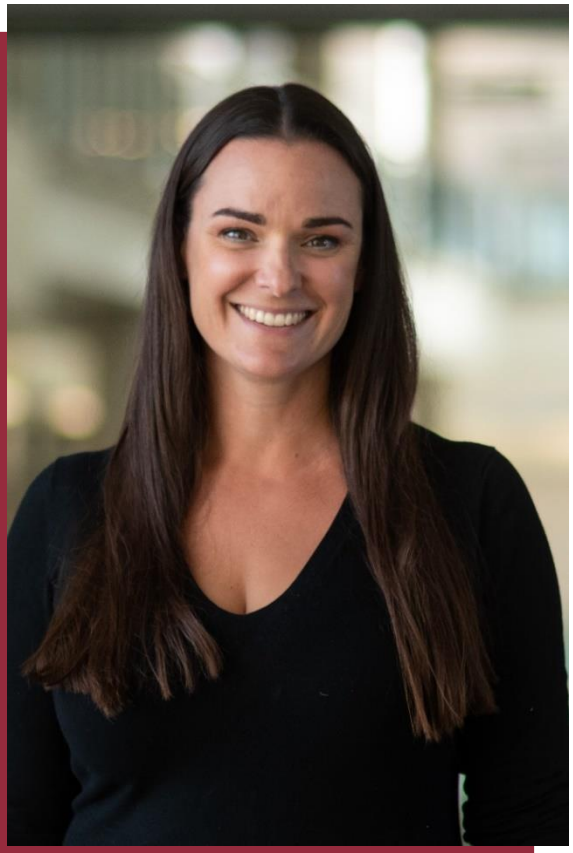
Dr. Craig Kuziemsky, Associate Vice-President, Research and Interim Dean, School of Business

Instructions for student presenters

Please ensure that prior to presenting you have logged into the zoom account through which you've registered for the conference. In order to present, you will be sharing your own computer screen with your oral or poster presentation all set up and ready to go. It is strongly encouraged for students to attend one of the **Presenter Tech Check Sessions** to ensure that you are familiar with the software and that there are no firewalls blocking screen sharing functions on your computer. Presenter Tech Check Sessions are from 8-9am on May 5th and 6th, as well as 12-1pm May 6th.

Keynote speaker

Dr. Torah Kachur- Friday May 6, 11:00 – 12:00 pm



Torah Kachur, PhD, is the CBC Radio National Science Columnist and a Contract Lecturer at the University of Alberta. After starting out in Genetics due to an administrative error, she found her calling. After graduating with Honors, Torah decided to pursue grad school and became passionate about worm gonads. After finishing her PhD, she quickly realized that the world was not in need of worm gonad experts and decided to pursue her love of teaching and of talking about science. A science communications course in Banff was the breakthrough she needed to inspire her, and a team of fellow grad students, to start Science in Seconds (SiS). SiS was a goofy blog and video series that was much more about making each other laugh and think than a wider audience but people loved it. That allowed Torah to have a portfolio of work that eventually launched her onto the airwaves at CBC - without experience or training - but 10 years later she is still on CBC and always learning. Join Torah in her talk about how to find your true calling, how to maximize your opportunities and sometimes, how to just roll with the punches.

Panel discussion

Career Panel: A winding road to success - Thursday May 5, 12:00 - 1:30 pm

Please join us over lunch for a panel discussion focusing on the diversity of careers in STEM. This year, we have the pleasure of talking with five STEM graduates (Kathy Janzen, Ebberly MacLagan, Garson Law, Nolan Steed, and Christopher Li) from across the province who have gone on to careers that utilized the skills and training of their degree(s) in both traditional and non-traditional ways. Each speaker will share their career journey and how their degree(s) prepared them for their current positions. Areas of expertise include chemistry, biology, environmental science, computer science, and health science. This is a great opportunity to hear about what you can do with your degree and ask questions to the panelists about navigating the STEM world outside of academia.

Conference at a Glance

DAY 1 | THURSDAY MAY 5, 2022

Presenter Tech Check Session	8:00 to 9:00 am
Welcome Remarks	9:00 to 9:30 am
Undergraduate Presentations	9:35 to 11:45 am
Physiology (1A)	
Computer Science/Physics (1B)	
Environmental Science (1C)	
Panel Discussion	12:00 to 1:30 pm
Undergraduate Presentations	1:45 to 3:30 pm
Biochemistry/Molecular Biology (BCMB) (1D)	
Health Sciences/Statistics (1E)	
Break	3:30 to 3:45 pm
Undergraduate Presentations	3:45 to 6:00 pm
Biology (1F)	
Health Sciences (1G)	

DAY 2 | FRIDAY MAY 6, 2022

Presenter Tech Check Session	8:00 to 9:00 am
Undergraduate Presentations	9:00 to 11:00 am
Health Sciences (2A)	
Biochemistry/Microbiology (BCMB) (2B)	
Keynote Session	11:00 to 12:00 pm
Presenter Tech Check Session	12:00 to 1:00 pm
Undergraduate Presentations	1:00 to 3:00 pm
Chemistry (2C)	
Biochemistry/Molecular Biology (BCMB) (2D)	
Statistics (2E)	
Closing Remarks	3:00 to 3:30 pm

Day 1 Student Presentation Schedule – Thursday May 5th

DAY	SESSION ID	TIME	ABSTRACT ID	FIRST NAME	LAST NAME	INSTITUTION	DISCIPLINE
9:00 to 9:30 am			Welcome Remarks				
MAY 5th, 9:35 to 11:45am	1A	9:35 to 9:55	1A-1	Rodion	Isakovich	Mount Royal University	Physiology
		9:55 to 10:15	1A-2	Banin	Al-Shimari	Mount Royal University	Physiology
		10:15 to 10:35	1A-3	Kathy	Le	Mount Royal University	Physiology
		10:35 to 10:50	1A-4	Vivian	Nguyen	Mount Royal University	Physiology
		10:50 to 11:05	1A-5	Jarod	Huhtala	Mount Royal University	Physiology
		11:05 to 11:25	1A-6	Marshall	Tontellato	Mount Royal University	Physiology
	1B	9:35 to 9:55	1B-1	Manan	Punjabi	Concordia University	Computer Science
		9:55 to 10:10	1B-2	Timothy	Meneses	Mount Royal University	Computer Science
		10:10 to 10:25	1B-3	Khoa	Bui	Concordia University	Computer Science
		10:25 to 10:40	1B-4	Zach	Sumners	University of Calgary	Physics
		10:40 to 10:55	1B-5	Rhythm	Mahajan	Concordia University	Computer Science
		10:55 to 11:10	1B-6	Supragyapal	Singh	Concordia University	Computer Science
		11:10 to 11:25	1B-7	Brad	Cronin	University of Calgary	Physics
	1C	9:35 to 9:55	1C-1	Haylee	Hatton	MacEwan University	Environmental Science
		9:55 to 10:15	1C-2	Helen	Tiet	MacEwan University	Environmental Science
		10:15 to 10:35	1C-3	Kaylee	Onucki	MacEwan University	Environmental Science
		10:35 to 10:55	1C-4	Cedrick	Ramos	MacEwan University	Environmental Science
		10:55 to 11:15	1C-5	Megan	MacElheren	Concordia University	Environmental Science
		11:15 to 11:30	1C-6	Bryce	Uitbeyerse	Concordia University	Environmental Science
12:00 to 1:30 pm			Panel Discussion				
MAY 5th, 1:45 to 3:30pm	1D	1:45 to 2:00	1D-1	Emily	Wong	Mount Royal University	BCMB
		2:05 to 2:20	1D-2	Trinity	Deak	University of Lethbridge	BCMB
		2:20 to 2:40	1D-3	Celina	Vipond	MacEwan University	BCMB
		2:40 to 3:00	1D-4	Anureet	Kaur	Concordia University	BCMB
		3:00 to 3:15	1D-5	Muhammad	Moshin	Mount Royal University	BCMB
		3:15 to 3:30	1D-6	Mark	Lea	University of Lethbridge	BCMB
	1E	1:45 to 2:05	1E-1	Janine	Heber	MacEwan University	Health Sciences
		2:05 to 2:20	1E-2	Alex	Engel	University of Lethbridge	Health Sciences
		2:20 to 2:40	1E-3	Jonah	Edmundson	The King's University	Health Sciences
		2:55 to 3:15	1E-4	Nicole	Walklin	MacEwan University	Health Sciences
3:30 to 3:45 pm			Break				
MAY 5th, 3:45 to 6:00 pm	1F	3:45 to 4:05	1F-1	Carisa	McGale	University of Lethbridge	Biology
		4:05 to 4:20	1F-2	Soniya	Bashyal	St. Mary's University	Biology
		4:20 to 4:35	1F-3	Taylar	Whidden	MacEwan University	Biology
		4:35 to 4:55	1F-4	Shaina	Selles	The King's University	Biology
		4:55 to 5:15	1F-5	Lina	Lim	MacEwan University	Biology
		5:15 to 5:35	1F-6	Nojan	Mannani	University of Alberta	Biology
		5:35 to 5:55	1F-7	Jaxon	Reiter	University of Lethbridge	Biology
	1G	3:45 to 4:05	1G-1	Dinith	Mudalige	University of Calgary	Health Sciences
		4:05 to 4:20	1G-2	Ismaeel	El-Hakim	MacEwan University	Health Sciences
		4:20 to 4:35	1G-3	Susana	Saud	University of Calgary	Health Sciences
		4:35 to 4:50	1G-4	Merrin	Monteith	University of Lethbridge	Health Sciences
		4:50 to 5:05	1G-5	Giulia	Cocco	University of Lethbridge	Health Sciences

Day 2 Student Presentation Schedule – Friday May 6th

DAY	SESSION ID	TIME	ABSTRACT ID	FIRST NAME	LAST NAME	INSTITUTION	DISCIPLINE
MAY 6th, 9:00 to 11:00am	2A	9:00 to 9:15	2A-1	Nik	Josafatow	University of Lethbridge	Health Sciences
		9:15 to 9:30	2A-2	Kale	Scatterty	MacEwan University	Health Sciences
		9:30 to 9:45	2A-3	Nicola	Schatz	University of Lethbridge	Health Sciences
		9:45 to 10:00	2A-4	Mitchell	Chorney	University of Alberta	Health Sciences
		10:00 to 10:15	2A-5	Alycia	Stewart	MacEwan University	Health Sciences
		10:15 to 10:30	2A-6	Andréa	Johnson	MacEwan University	Health Sciences
		10:30 to 10:45	2A-7	Merry Faye	Graff	Mount Royal University	Health Sciences
	2B	9:00 to 9:15	2B-1	Gina	Friedrich	Concordia University	BCMB
		9:15 to 9:35	2B-2	Tae Hwan	Kim	MacEwan University	BCMB
		9:35 to 9:55	2B-3	Zafina	Budhwani	Mount Royal University	BCMB
		9:55 to 10:15	2B-4	Jenna	Sullivan	University of Lethbridge	BCMB
		10:15 to 10:35	2B-5	Casey	Belway	The King's University	BCMB
		10:35 to 10:55	2B-6	SarahAnn	Walker	University of Lethbridge	BCMB
11:00 to 12:00 pm			Keynote Session				
12:00 to 1:00 pm			Presenter Tech Session				
MAY 6th, 1:00 to 3:00pm	2C	1:00 to 1:20	2C-1	Gaganpreet	Gill	MacEwan University	Chemistry
		1:20 to 1:40	2C-2	Abbie	Ruletz	University of Alberta	Chemistry
		1:40 to 2:00	2C-3	Sarah	Ritter	Ambrose University	Chemistry
		2:00 to 2:15	2C-4	Haley	Wolgien	Concordia University	Chemistry
		2:15 to 2:35	2C-5	Benjamin	Bekkema	MacEwan University	Chemistry
	2D	1:00 to 1:20	2D-1	McKayla	Kirkpatrick	MacEwan University	BCMB
		1:20 to 1:40	2D-2	Daniah	Alkassab	Mount Royal University	BCMB
		1:40 to 2:00	2D-3	Emily	Mertens	University of Lethbridge	BCMB
		2:00 to 2:20	2D-4	Sarah	Balderas	University of Lethbridge	BCMB
		2:20 to 2:40	2D-5	Yamin	Raza	University of Lethbridge	BCMB
		2:40 to 3:00	2D-6	Christa	Powers	Mount Royal University	BCMB
	2E	1:00 to 1:20	2E-1	Bethany	Snaterse	The King's University	Statistics
		1:20 to 1:40	2E-2	Brian	Auth	Mount Royal University	Statistics
		1:40 to 2:00	2E-3	Nahuel	Paladino	Mount Royal University	Statistics
		2:00 to 2:20	2E-4	Joel	Conley	Mount Royal University	Statistics
		2:20 to 2:35	2E-5	Joletta	Van Rhijn	University of Lethbridge	Computer Science
3:00 to 3:30 pm			Closing Remarks				

Abstracts by Session

Students have 15 minutes to present for oral presentations and 10 minutes to present for poster presentations. Additionally, each student will also have a 5-minute question period. An asterix (*) indicates a poster presentation. When multiple authors are listed, underlined names indicate the student that is presenting at the conference.

Session 1A|Physiology| May 5th 9:35 to 11:25 am

Abstract ID: 1A-1

A NOVEL ANALYTICAL PERSPECTIVE OF VENTILATORY ACCLIMATIZATION TO HYPOXIA DURING INCREMENTAL ASCENT TO 5160M

[1]Rodion Isakovich, [1]Valerie C. Cates, [1,2]Jack K. Leacy, [2]Ken D. O'Halloran, [3]Thomas D. Brutsaert, [4]Mingma T. Sherpa, [1]Trevor A. Day

[1]Department of Biology, Faculty of Science and Technology, Mount Royal University, Calgary, Alberta, Canada

[2]Department of Physiology, School of Medicine, University Cork College, Cork, Ireland

[3]Department of Exercise Science, Syracuse University, Syracuse, New York, USA

[4]Kunde Hospital, Khunde, Solukhumbu, Nepal

High altitude (HA) ascent imposes systemic oxygen deprivation (hypoxia), and increased risk of altitude illnesses. Acute hypoxia elicits a compensatory hypoxic ventilatory response (HVR), which is augmented with chronic exposure to HA, termed ventilatory acclimatization (VAH). However, HVR tests lack portability and feasibility in HA fieldwork expeditions. We aimed to characterize VAH during ascent to HA using portable metrics and area-under-the-curve (AUC) on modified "Fenn" diagrams, by plotting measurements of end-tidal carbon dioxide ($P_{ET}CO_2$) against peripheral oxygen saturation (SpO_2) with incremental ascent to HA. Due to increased ventilation and concomitant CO_2 elimination, along with improved oxygen saturation with ascent to HA and VAH, we hypothesized that highly acclimatized participants would have a smaller AUC on Fenn diagrams. Morning $P_{ET}CO_2$ and SpO_2 measures were collected on 46 participants during an incremental ascent over 10 days to 5160m in the Nepal Himalaya. For each participant, AUC was calculated from individually-constructed Fenn diagrams, and ranked from smallest to largest. A trichotomized split was performed to group the smallest, medium, and largest magnitudes of AUC into high (n=15), moderate (n=16), and low (n=15) degree of acclimatization cohorts, respectively. There were significant differences between the AUC magnitudes of the three groups ($P<0.0001$), which had similar trends to previous reports from lab studies. Our novel analysis suggests that AUC on individual Fenn diagrams can be used to quantify VAH using portable metrics in large groups of trekkers during incremental ascent to HA. Here we provide normative values for use in future research and trekking expeditions.

Abstract ID: 1A-2

THE ROLE OF THE ANKLE JOINT TO MAINTAIN STABILITY WHILE WALKING ON UNEVEN SURFACES

Banin M. Al-Shimari[1], Michael J. Asmussen[1]
[1]*Department of Biology, Mount Royal University*

Walking can pose a challenge to stability in the medial and lateral direction (i.e., to the inside or outside of your foot), which is exacerbated on uneven surfaces. Humans adopt several strategies to correct this instability. During the stance phase of walking, the subtalar and ankle joint displacements are counteracted by forces produced by muscles and passive tissues, causing energy absorption which is returned in late stance to power the foot into push-off. Therefore, the purpose of this study is to determine the compensatory strategies utilized by the subtalar and ankle joint under mediolateral perturbations, induced using lateral and medial ridges on 3D printed custom-made footwear, promoting and limiting pronation, respectively. Participants (n=10) walked in footwear at a walking speed of 1.8 m/s. At the subtalar joint, a greater supination moment was produced in the lateral ridge condition to counteract over-pronation (p<0.05). More positive power was produced at the subtalar joint in the lateral ridge condition (p<0.05), corresponding to a reduction in positive power at the ankle joint (p<0.05), suggesting a redistribution of power production across the two joints. Additionally, greater dorsiflexion in the medial ridge condition (p<0.05) indicates that the subtalar and ankle joints work in unison whereby less motion at one joint is compensated by an increase in motion in the other joint. Therefore, the subtalar and ankle joints are effective in compensating for instability in the medial and lateral directions.

Abstract ID: 1A-3

USING ELECTROMYOGRAPHY AS A NOVEL ASSESSMENT TOOL IN MULTIPLE SCLEROSIS

Kathy Le, Dr. Michael Asmussen
Mount Royal University

Multiple sclerosis (MS) is a challenging disease to diagnose and treat because of the variety of symptoms and the multiple ways they can present in each individual. However, as new treatments and therapies are being developed, the need for accessible and reliable tools that measure disease progression has become increasingly important. Recently, a new device has been developed to measure tibialis anterior (TA) force – a muscle in your lower leg responsible for lifting your foot up. This novel device has been proven to be both easy to use, reliable, and valid. Studies have shown that electromyography (EMG), a measure of muscle activity, can give an estimate of muscle force and may be leveraged to create new technologies to track disease progression and treatment modifications effectiveness. The purpose of this study is to develop new data processing methods to access muscle function in PwMS so that EMG signals can be used with or without existing muscle function tests to track MS symptoms. Working with data of 20 individuals without MS and 20 individuals with MS, a custom data processing code featuring different signal processing techniques will try and relate EMG signals to underlying muscle force. It is anticipated that EMG signals will be strongly and positively correlated to muscle force output of the TA in both individuals with and without MS and that the results will identify the differences between the EMG signals of the two populations. If true, this data processing method will improve the muscle test assessments in PwMS.

Abstract ID: 1A-4*

RUNNING WITH VARYING STIFFNESS ACROSS DIFFERENT SHOES AFFECT LOWER LIMB BIOMECHANICS

Vivian Nguyen, Dr. Michael Asmussen
Mount Royal University

Footwear longitudinal bending stiffness has been shown to affect a person's lower-limb biomechanics during running. However, the underlying mechanisms of why longitudinal bending stiffness affects lower limb biomechanics are not well understood. Additionally, there are a lack of studies focusing on the effects of footwear stiffness on a person's biomechanics during non-linear running, which may have different footwear requirements relative to linear running. The aim of this study was to investigate how running with varying stiffness across different shoes may affect lower limb biomechanics. This study utilized previously collected data from Cigoja et al. (2019), where thirteen male, recreational runners ran on an instrumented treadmill at 3.5 m/s in four shoe conditions with modified stiffness from a carbon fibre insole: (1) control conditions in both shoes, (2) stiff conditions in both shoes, (3) stiff condition in right shoe only and (4) stiff condition in left shoe only. Motion capture and force platform data were collected and analyzed using a custom MATLAB code. We anticipate that increased footwear longitudinal bending stiffness will be found to significantly decrease negative metatarsophalangeal (MTP) joint work, increase positive MTP joint work, and decrease positive ankle joint work in stiff shoes. Further, running in varying stiffness conditions on each foot (2,3) will cause a "blur" between data from the combined stiffness (4) and no stiffness (1) conditions. If true, this data will help shoe manufacturers design footwear that has varying requirements for each foot.

Abstract ID: 1A-5*

DYNAMIC ANKLE STABILITY AND THE POTENTIAL INFLUENCE OF CONNECTIVE TISSUE DISEASE (EDS) ON TENDON STIFFNESS AND THE ENERGY COST OF RUNNING

Jarod Huhtala, Dr. Michael Asmussen
Mount Royal University

Our project focuses on the relationship between the energy cost of running and dynamic joint stabilization, and how that can be affected in individuals with musculotendinous stiffness deficits.

The link between running economy and muscle stability is not well established in the literature. Traditionally, running economy has been measured using maximal oxygen uptake, but more recent approaches take energy expenditure into account. Neural control of stability uses energy to make a muscle more or less stiff to stabilize the lower extremity, particularly at the foot and ankle. A literature review was conducted to investigate the relationship between running economy and the energy cost of stabilizing muscles in the foot-ankle complex. Studies have shown that there seems to be an optimal level of stiffness that can optimize running economy in runners. By improving force coupling in the tibialis anterior-tibialis posterior, gastrocnemius-tibialis anterior, and by strengthening peroneus longus, functional tendon stiffness in the foot-ankle complex should increase, while also keeping energy expenditure minimal. Specifically, it was hypothesized that the creation of a “muscle brace”, acting as scaffolding around an injury-susceptible joint by increasing tendon stiffness in certain muscles, can improve running economy while stabilizing the foot-ankle complex at a minimal energy cost. From this hypothesis, we developed a particular interest is the relationship between muscle stiffness and connective tissue disorders, such as Ehlers-Danlos Syndrome (EDS). In connective tissue disorders, there is a decrease in regional tendon stiffness, and as with other injuries such as calcaneal tendinopathy and patellar tendinopathy, this may impact the energy cost of stabilizing joints using this “muscle brace”. Therefore, the relationship between running economy, muscle-driven joint stability and EDS should be further evaluated.

Abstract ID: 1A-6

THE STANDING HYPOXIA EXPERIMENT: AN INVESTIGATION OF STANDING BALANCE IN LOW OXYGEN AND DUAL TASK CONDITIONS

Marshall Tonellato[1], Valarie Cates[1], Nick Strzalkowski[1,2]
[1]Faculty of Science and Technology, Mount Royal University, Alberta, Canada,
[2]Faculty of Teaching and Learning, Mount Royal University, Alberta, Canada

Millions of people live in high altitude environments and thousands more travel to the mountains each year. Mountaineering is inherently dangerous, and the hypobaric hypoxic (lower barometric pressure, lower oxygen) high altitude environment is a major physiological stressor. It is important to understand the physiological impacts of living at high altitude, however high-altitude research poses numerous experimental and logistical challenges. The physiological impact of hypoxia can be studied at low altitudes by altering the fraction of inspired oxygen (F_IO_2). The objective of the present study was to investigate the influence of normobaric (normal pressure) hypoxia on standing balance under single/dual-task conditions, with/without vision. To date, 14 participants (10 men, 20-30 years old) stood on a force plate for 16, 90 second trials. Four balance conditions, single-task (quiet stance) or dual-task (audio Stroop test), with eyes open or eyes closed, were studied at four oxygen conditions, 16% F_IO_2 (simulated 3440 m), 14.5% F_IO_2 (4240 m), 13% F_IO_2 (5160 m), and room air (21% F_IO_2, at 1045m). Center of pressure measures (95% ellipse area, total path length) were calculated to quantify postural sway. Stroop test accuracy and reaction times were measured. Our preliminary findings show the average path length and 95% ellipse increased when comparing room air to 13% F_IO_2 conditions. As F_IO_2 was lowered, oxygen saturation and end-tidal gas oxygen concentrations were reduced, indicating normobaric hypoxia was induced. Early results support our hypothesis that acute normobaric hypoxia can amplify balance impairment and simulate high altitude conditions.

Session 1B | Computer Science and Physics |May 5th 9:35 to 11:25 am

Abstract ID: 1B-1

DEVELOPMENT OF KEY LOGGER SOFTWARE AND MACHINE LEARNING BASED METHODS TO DETECT UNKNOWN KEY LOGGERS

Manan Punjabi
Concordia University

Key loggers are hardware devices or software programs used to harvest confidential information. Key loggers are a form of spyware where users are unaware their actions are being tracked. Key loggers can be used for a variety of purposes; hackers may use them to maliciously gain access to your private information, while employers might use them to monitor employee activities. Key loggers are also used for legitimate purposes such as parental monitoring for their children's activities. The main objective of this research is to develop software based key logger and explore machine learning based methods to detect and terminate the unknown key logger running in stealth mode to prevent data loss and sensitive information leakage. A comparative study has been conducted to measure the performance of key logger detection by different machine learning methods. The motive of this research is to educate the general audience about key loggers and how to prevent them.

Abstract ID: 1B-2*

IMPLEMENTATION AND SIMULATION EVALUATION OF NUDGE-K SCHEDULING ALGORITHM

Timothy Meneses, Maryam Elahi
Mount Royal University

Scheduling policy is the method of arranging the order of tasks and assigning it with an available resource. In computing, the resource is the Central Processing Unit (CPU) and the scheduling algorithm chooses which job is processed at a specified period. The most common scheduling algorithm is First Come First Serve (FCFS) where jobs are serviced based on the order they arrive. FCFS is simple to implement and preserves fairness based on the arrival order. However, FCFS has an inherent issue of long average response time (the time from the arrival of a job until its completion). A very large job may arrive first and shorter jobs will be in the queue waiting for the large job to finish. The Nudge Scheduling algorithm is proven to improve upon FCFS by allowing arriving small jobs to "nudge" (get ahead of) a large job at the end of the queue. However, analysis of Nudge in literature is limited to the case where a large task is nudged at most once.

We introduce Nudge-K, an algorithm that allows large tasks to be nudged up to K times. We compare Nudge-K to FCFS using a simulation tool under varying values of K and different arrival rates and job size distributions. Our results showed that increasing K significantly improved the average response time and the average wait time proportional to job sizes. In addition, Nudge-K also enhances the average wait time for the class of small jobs while preserving the experience for large sized jobs.

Abstract ID: 1B-3*

A REINFORCEMENT LEARNING BASED ALGORITHM FOR DEVELOPING STACKING GAMES

Khoa Bui
Concordia University

Artificial Intelligence (AI) and machine learning have been instrumental in designing intelligent programs to enhance humans' understanding of games, and players' experiences by generating responsive, and adaptive behaviors in a computer program. In 2016, Google utilized a sophisticated Reinforcement Learning (RL) algorithm to develop a program called AlphaGo to defeat the World's best human Go player, an achievement thought to be impossible. The challenge lies in the complexity of these board games, with Go having approximately 2.1×10^{170} possible moves. Even the most powerful supercomputers lack the processing power to analyze all the moves in any reasonable amount of time.

Inspired by the AlphaGo project, this research aims to develop an AI that is capable of playing a set of board games called stacking games. Stacking games are computational interesting due to the "stacking" operation that requires the game to be played on multiple boards, and the moves dictate which board the next move will be played on. Due to this reason, our agents will need to collect more information, be capable of adapting to multiple environments, and performs actions accordingly. In this research, we examine the results of a Monte Carlo Tree Search algorithm-based AI playing the game Ultimate Tic-Tac-Toe. In the future, we would like to explore how other computational techniques perform for other stacking games and deploy these games and AI to the general audience.

Abstract ID: 1B-4*

THE APPLICATION OF CROSS CORRELATION METHODS TO ANALYZE MOLTEN SALT REACTOR FLOW CONDITIONS

Zach Sumners
Department of Physics and Astronomy, University of Calgary

Molten salt nuclear reactors (MSRs) have great potential to generate electricity and process heat with no greenhouse gas emissions. Molten salt environments make *in situ* sensor measurements for detailed fluid flow monitoring difficult. To overcome this barrier, we propose using non-invasive ultrasonic cross-correlation measurement techniques to identify statistical parameters of the fluid. We believe these measured values could determine flow conditions within reactor piping without having to install any sensors inside reactor pipes. The authors are developing a numerical simulation of molten salt flow in a reactor pipe and to test ultrasonic measurements in a variety of flow conditions. Should the ultrasonic cross-correlation technique be successful for molten salt solutions, it can provide high accuracy monitoring of the molten salt solution without having to change inherent reactor design.

Abstract ID: 1B-5*

OBJECT DETECTION IN PYTHON USING OPENCV

Rhythm Mahajan
Concordia University

Object Detection is one of the most important use cases in the field of Computer Vision. It has many use cases including training the software to distinguish people, particularly trained objects such as cars in a moving video, walking pedestrians, and so on. While we as humans can do this instantaneously, getting the software to do this requires the use of well-trained algorithms. So, in this project, I will be building an object detection system that will consider the basic idea by which moving scenes are generated, a combination of frames. Frames can be accessed as singular images with various objects in them with a relative distance between them. We can separate the objects using a boundary such as a box. Isolating the object as the only thing at different positions in different frames relative to the surroundings can be done by using image dilation and thresholding. To do this, I will be using Python and its OpenCV library. The use cases of this project can be in traffic management systems, license plate detection, and crowd counting.

Abstract ID: 1B-6*

KEEPING YOUR DATA SAFE USING NUMBER THEORY AND ABSTRACT ALGEBRA

Supragyapal Singh
Concordia University

Elliptic curve cryptography (ECC) is one of the most popular modern crypto systems being used in secure data transmission because of its efficiency yet providing the equivalent security to crypto systems not based on elliptic curves. In this presentation, we will discuss the mathematical background behind crypto systems that are based on the algebraic structure of elliptic curves over finite fields. Furthermore, we will present real-life applications of ECC by introducing the Diffie-Hellman key exchange and El Gamal asymmetric crypto system.

Abstract ID: 1B-7*

PHOTOMETRIC ANALYSIS OF NGC 2158

Brad Cronin, Trace Harms, Dr. Phil Langill
University of Calgary

We present a photometric and astrometric analysis of NGC 2158, an open cluster in the constellation Gemini, using data taken with the Rothney Astrophysical Observatory's Clark Milone Telescope (RAO-CMT) near Calgary, Alberta, and the Dominion Astrophysical Observatory's (DAO) Plaskett Telescope, in Saanich, British Columbia. The photometric analysis of NGC 2158 was conducted by investigating g' and r' filter images using Mira Pro software. The photometric zeropoint for the images was calculated using calibration data of known stars in the cluster and its local vicinity, taken from the SIMBAD Astronomical Database. The cluster was determined to have an overall B-V colour index of 0.19 ± 0.88, indicating that the most numerous class of star is likely A7. The total number of stars in NGC 2158 was determined to be 1600 ± 275, for a total combined mass of $2930 \pm 490\ M_{\odot}$.

Session 1C | Environmental Science |May 5th 9:35 to 11:30 am

Abstract ID: 1C-1

MICROPLASTIC CONSUMPTION TRENDS IN AQUATIC INVERTEBRATES IN EDMONTON, ALBERTA STORMWATER PONDS, AND NATURAL WETLANDS

Haylee Hatton, Dr. David Locky, Dr. Matthew Ross
MacEwan University

The increasing global production and use of plastics have made plastic pollution an emergent environmental problem. Research on marine microplastics is relatively advanced compared to that in freshwater ecosystems; there is limited knowledge of freshwater microplastic abundance and how it interacts with organisms. Amphipods (*Gammarus* spp.) are invertebrates ubiquitously found in various freshwater ecosystems. They are key components in food webs as bioturbators, nutrient transformers, and food for water birds, fish, amphibians, and other invertebrates. Recent work has demonstrated that amphipods readily ingest microplastics in the form of fibers and fragments. Given their position in the food web, this could lead to microplastic bioaccumulation. The aim of this project is to determine the extent of microplastics uptake by amphipods collected from natural, highway, and residential sites in the greater Edmonton region, Alberta. Amphipods collected at each site will be chemically digested using sodium hypochlorite and acetic acid, then filtered to isolate microplastic particles. Particles are stained with Nile Red and imaged with florescence microscopy to facilitate counting, and further analyzed by Raman spectroscopy to visualize and classify microplastics based on their morphology, color, length and chemical composition.

Abstract ID: 1C-2

THE ACCUMULATION OF MICROPLASTICS IN DIFFERENT ESTUARIES

Helen Tiet, Dr. Matthew Ross and Dr. Hilary Corlett
MacEwan University

Microplastics are primarily produced by the fragmentation of larger plastic materials via physical, chemical, or biological means. They are carried by wind and water to various marine environments, such as estuaries, and deposited into sediments. Estuaries are microplastic sinks and can provide information about dominant plastic types and microplastic retention in marine environments. Various studies have produced inconsistent results when comparing microplastics and their sediments. The amount of microplastics accumulated in the sediments is thought to depend on grain size. Samples were collected from two locations along the western coast of North America (Craigs Bay and Netarts Bay) to determine if different depositional environments affect the accumulation and retention of microplastics. Approximately 12.5g of each sample was sifted through various sieves (4000, 2000, 1000, 500, 250, 125, and 63µm, respectively) to determine their grain size distributions and dominant grain size. Microplastics were extracted from an unsorted portion of each sample using a density floatation and enzyme digestions. They were also classified by shape: fragment, fiber, film, and pellets. The overall quantity in each sample was combined with each samples' grain size distribution to determine if the different depositional environments affect the accumulation and retention of microplastics. The work is part of a new and emerging research area within sedimentology that focuses on the correlation between sediments and microplastics.

Abstract ID: 1C-3

SPECTROSCOPIC INVESTIGATION OF CADMIUM SORPTION TO ONCOIDS

Kaylee Onucki, Dr. Janice P. L. Kenney
MacEwan University, Department of Physical Sciences

There is a growing interest in preserving water quality, prevention of contamination and remediation of water systems. Once a metal contaminant enters a system, it is important to understand how the minerals and microbes making up a system will react to the contaminant. In this study, we are interested in how oncoids, nodular coated grains formed by biological activity in water environments, found in an alkaline lake in the Canadian Rockies, would take up metals in a contamination event. Oncoids were collected from a carbonate-rich mountain lake in western Alberta. The oncoid material was dissected and exposed to Cadmium (Cd), a highly toxic metal. The pH range studied was between 4-11. Following exposure, the oncoid was removed from the solution and the aqueous phase was analyzed by inductively coupled plasma optical emission spectroscopy (ICP-OES), while the oncoid was analyzed using Fourier transform infrared (FTIR) spectroscopy. Raman spectrometry was used to characterize variations in the Cd binding across the oncoid. Adsorption of Cd by the oncoid was found to increase as a function of pH, 24% at pH 4 rising to as high as 96% at pH 11, however above pH 8 much of that removal from solution was related to Cd precipitation. Assessing how environmental components, such as oncoids take up metals, such as Cd, is important as it could inform us on possible syncs of metals, to improve water qualities and environmental hazards in present day contamination events, but also inform us of potential metal syncs in geologic history.

Abstract ID: 1C-4

CARBONATE SEDIMENTOLOGY OF CORAL REEFS IN SUMBA ISLAND, INDONESIA

Cedrick Ramos
MacEwan University

The Island of Sumba, Indonesia, comprises several reef terraces formed by changing global sea levels and episodic tectonic activity. Volcanic-derived sediment has been found to have been incorporated into reef fabrics without impacting coral growth. The uninterrupted reef growth shows a conflicting theory that coral reefs do not survive under significant clastic input. Continuous reef growth has been documented in this region known as the Coral Triangle. However, it is unclear whether intervals of increased clastic content affect coral growth strategies or whether the immature nature of the volcaniclastic sediment (larger and angular grain) explains why clastic input does not choke corals. This study employs various thin sections from Pleistocene-age fossil reefs to document and characterize the sediment's size and circularity, which is a measure of sediment maturity. The study involves imaging analysis by taking images of each thin section. The thin sections have all been stained with Alizarin red, a stain that only turns calcite or aragonite grains a shade of red, and all other minerals remain unstained. Then, the images were colour indexed to black and white, with clastic grain appearing as white. The images underwent thresholding to isolate the white grains to measure their circularity and sizes. A range of grain sizes in these sections have revealed that some of the grains detected are small enough to enter corallites and pores in the coral skeleton, while others are much larger and would not impact the coral growth.

Abstract ID: 1C-5

EFFECTS OF GRASSLAND MANAGEMENT TECHNIQUES ON SOIL MICROBIAL COMMUNITY STRUCTURE

Megan MacElheren, Dr. Emmanuel Mapfumo, Dr. Deborah Hemmerling
Concordia University, Department of Biological and Environmental Sciences

The conversion of grasslands to croplands due to grassland productivity declines is resulting in a loss of valuable carbon sinks across the globe. Innovative grassland management approaches are required to improve carbon sequestration of grassland soils and to maintain productivity of said grasslands. Formation of topsoil is heavily influenced by interaction between plant roots and soil microbes: termed the microbial bridge. The microbial bridge is essential for carbon flow within soils and in maintaining the productivity of grasslands. The objective of this study was to determine whether the presence of livestock grazing, or inclusion of legumes would enhance the microbial activity of grassland soils. The study site was located at Lacombe Research Center, on Orthic black chernozem soils. Microbial soil health indicators were assessed and included measurements of pH, soil organic carbon, active carbon, soil respiration, soil protein index, and ongoing work is being completed on soil microbial composition by looking at DNA. The results suggest a difference in microbial activity and abundance between treatments. Soil pH differed between treatments, with no identifiable pattern as to the influencing factor on pH. In general, alfalfa plots that were grazed by cattle had 2.9 times less active carbon (mg/kg) than controls. No significant difference was observed in percent organic matter between treatments. No critical differences in soil respiration were observed between treatments. Critical differences were observed in soil protein measurements, where all treatments differed significantly from controls. DNA extraction from soil samples was successful, however the extracted DNA was not successfully amplified via PCR. Continued work on the PCR setup for soil DNA amplification is being completed. The significance of these findings in developing grassland management strategies is discussed.

Abstract ID: 1C-6*

THE CHRONIC EFFECT OF IBUPROFEN ON THE LIFE HISTORY TRAITS OF DAPHNIA MAGNA

Bryce Uitbeyerse
Concordia University

Pharmaceuticals are becoming a more prevalent pollutant in aquatic ecosystems. Ibuprofen is one of the emerging pharmaceutical pollutants. In this experiment we examine the effects of current environmental concentrations of ibuprofen in Canadian surface waters on *Daphnia Magna*. Three treatments of ibuprofen concentrations were looked at: 0.0 ug/L, 1.0 ug/L and 4.0 ug/L. Five neonates were selected for each treatment and placed one-liter beakers with two replicates for each treatment. The daphnia were examined visually for four weeks every two days for life history traits.

Session 1D | Biochemistry and Microbiology (BCMB)| May 5th 1:45 to 3:30pm

Abstract ID: 1D-1*

DO EXTRACELLULAR MATRIX PROTEINS FIBRONECTIN, GELATIN, AND LAMININ AFFECT CELL MORPHOLOGY AND MYOGENESIS PROGRESSION IN C2C12 MOUSE CELLS?

Emily Howard, Haley Leavitt, Hazel Macaldo, Nicholas Pannell, Ian Parsons, Brandee Tucker, Emily Wong, and Dr. Laura Atkinson
Mount Royal University

During myogenesis, mononucleated myoblasts fuse and elongate to form multinucleated myotubes. This differentiation process can be recreated *in vitro*, however, these cell cultures typically lack extracellular matrix (ECM) proteins such as fibronectin, gelatin, and laminin, which are crucial for cell migration, organization, and development. We grew C2C12 cells on fibronectin, laminin, or gelatin-coated plates and compared them to an uncoated control group to observe the effects of ECM proteins on myogenesis. Cells were sampled at the myoblast stage, 100% confluency or day 0, and days 4, 7, and 12. Alpha-actin and myosin heavy chain 4, two late-stage markers of myogenesis that form the contractile units of mature muscle, were analyzed using immunocytochemistry and qPCR. Immunocytochemistry imaging showed alpha-actin and myosin localized exterior to the nucleus, elongated and aligned as the cells differentiated, and earlier expression of alpha-actin and myosin in the fibronectin and gelatin groups. Phase contrast images revealed cells in all ECM-coated groups grew in linear, parallel arrangements, while cells on uncoated plates grew in scattered arrangements. qPCR was used to determine relative gene expression for skeletal alpha-actin was increased in gelatin and myosin was increased in laminin, indicating ECM proteins advanced developmental processes. We propose the use of ECM proteins in future muscle-related studies *in vitro*, as they aid in the migration, organization, and overall development of muscle cells.

Abstract ID: 1D-2*

A COMPUTATIONAL STUDY OF THE STRUCTURAL CHANGES TO SIRNA INDUCED BY 2'-OME MODIFICATIONS

Trinity K. Deak, James M. B. McFarlane, Bhadra Pandya, and Stacey D. Wetmore
University of Lethbridge

Small interfering RNA (siRNA) is a promising molecule for RNA therapeutics due to its ability to downregulate the translation of mRNA. Synthetic siRNA molecules can be designed to selectively target mRNA for degradation to control the production of proteins related to a particular disease. However, naturally occurring siRNA is a poor medicinal agent, as the body has numerous mechanisms to expel exogenous double-stranded RNA. To attenuate the issues of poor cellular uptake and rapid degradation in the body, chemical modifications at the nucleobase or sugar–phosphate backbone have been employed. One such modification involves replacing the hydroxyl group at the 2' position of ribose with a different chemical group, most commonly fluorine, O-methyl (OMe), or methylethoxy (MOE). While these modifications have been shown experimentally to increase the resistance of siRNA therapeutics to degradation relative to unmodified siRNA and FDA-approved drugs exist that contain such modifications, little is known about the structural impacts of these modifications. To better understand the chemistry of popular siRNA modifications, this research uses molecular dynamics (MD) simulations to investigate the structural dynamics of double-stranded siRNA containing multiple 2'-OMe modifications in different sequence contexts. The structural insight gained from this work is critical to the future rational design of new siRNA-based therapeutics.

Abstract ID: 1D-3

CHARACTERIZATION OF NOVEL BMP3 MUTANTS AND THEIR IMPACT ON CELLULAR SIGNALING PATHWAYS

Celina M. Vipond, Fox, S. C., Lehman, O. J., Waskiewicz, A. J., and L. B. Prichard
MacEwan University, Department of Biological Sciences

BMP3 is a diffusible morphogen that is relevant to various critical developmental processes, and changes to this protein may result in disruptions to the signaling pathways and subsequent phenotypes involved. For example, a BMP3 mutation in zebrafish has been shown to result in ocular and skeletal abnormalities (Fox et al., 2022). To further elucidate the impact of mutation at the cellular level, we will investigate the effects of three novel BMP3 mutations previously implicated in the ocular disease coloboma on downstream cellular signaling mechanisms. To do this, we will utilize a tissue culture system to analyze each mutant's ability to be secreted and subsequently activate downstream cellular signaling. Previously, Cos7 cells were transfected with vectors containing V5-tagged BMP3 mutant genes, and the resulting BMP3 expression and secretion has been analyzed through immunoblot of transfected cell lysates and harvested incubation media. Our hypothesis is that if the mutant BMP3 signaling molecules are functional, they will be secreted by transfected cells into the incubation media and will then activate autocrine and paracrine BMP3 signaling. We will examine the activation of a hypothesized BMP3 signaling pathway through downstream effector Smad3 from both BMP3 transfected cells, as well as untransfected Cos7 cells incubated in transfected cell secreted media. We expect that mutants A470P and S393F will not be secreted nor be able to activate Smad3, as their mutations have accompanied folding changes that likely effect transport and ligand-receptor binding (Fox et al., 2022). F450Y, which has previously been shown to be secreted (Fox et al., 2022), is likely to have a deficiency in signaling, which may be confirmed by phospho-smad analysis. Overall, this research will aid in our understanding of BMP3 secretion and signaling and will expand on how changes to these essential processes can be related to disease and abnormal phenotypes previously discovered.

Fox, S. C., Widen, S. A., Asai-Coakwell, M., Havrylov, S., Benson, M., Prichard, L. P., Baddam, P., Graf, D., Lehman, O. J., and A. J. Waskiewicz. (2022). Analysis of BMP3 as a candidate locus for coloboma. *Human Genetics* (in press)

Abstract ID: 1D-4

THE SMED PROTEIN INVOLVEMENT DURING CENTRAL NERVOUS SYSTEM REGENERATION IN PLANARIA AFTER EXPOSURE TO ULTRAVIOLET RADIATION

Anureet Kaur
Concordia University

The Genus *Planaria* is one of the most common model organisms utilized in neurological research due to its high rates of regeneration from pluripotent stem cells. In planaria, the cerebral ganglia can also be regenerated after amputation, like any other organ in its body. Planaria commonly reside in freshwater and can be found in all parts of the world, including Alberta. Due to environmental causes, such as climate change, acid deposition, and other anthropogenic stressors, most aquatic organisms are exposed to higher levels of ultraviolet radiation (UV) which affects the development and regeneration of these organisms. Various common genes and proteins, including the Smed protein, are present in both planaria and humans and play important roles during regeneration. However, the function of the Smed's role in humans is yet unknown. The objective of this research is to determine the patterns of Smed protein involvement during the regeneration of the planaria's central nervous system (CNS) after exposure to Ultraviolet B radiation. The planaria were immunostained with anti-Smed and DAPI and observed by immunofluorescence. As Smed is present at the start of the regenerative process, it was hypothesized that it'd be present in high concentrations at the cerebral ganglia and progressively continue toward the ventral nerve cords to regenerate the planarian CNS until the regeneration process is complete. In comparison to the control group, the experimental groups exposed to UV-B radiation resulted in slower regeneration of the CNS.

Abstract ID: 1D-5*

EXPRESSION OF MYOD AND M-CADHERIN IN C2C12 CELLS AT THE ONSET OF DIFFERENTIATION INDUCED BY CELL-TO-CELL CONTACT VERSUS REDUCTION IN GROWTH FACTORS

Group 2: Bridgitte Garcia, Carita Chan, Emily Yap, Jessy Santos, Muhammad Mohsin, Naomi Oviahon
Mount Royal University

Muscle cell differentiation involves myoblast fusion to form multinucleated myotubes. MyoD is a master regulator of myogenic gene expression that is activated early in myogenesis and m-Cadherin mediates cell fusion as a transmembrane protein. Differentiation of the C2C12 cell line can be induced via cell-to-cell contact or reduction of growth factors (GF) via the usage of starvation media. Literature often utilizes varying differentiation conditions, despite condition-specific effects remaining largely unknown; hence, we aim to study the effects of cell-to-cell contact and GF reduction on C2C12 cell differentiation at myoblast stage (MB), days 0, 4, 7, and 11. Cells in starvation media (SM) containing horse serum (HS) are expected to achieve enhanced myotube formation and exhibit higher expression of target genes (MyoD and m-Cadherin) versus cells in growth media (GM) containing fetal bovine serum (FBS). Samples were subjected to immunocytochemistry (ICC) to visualize the localization of targets, qPCR and Pfaffl to assess target gene expression relative to GAPDH. Localized expression of MyoD in the nucleus is required to activate myogenic genes, whereas membrane localization of m-Cadherin mediates the cell fusion prior to myotube formation. Regarding qPCR, MyoD and m-Cadherin expression are expected to be highest during the earlier stages of myogenesis. ICC results exhibit significant deviation from the literature; further analysis is required to review the specificity of antibodies used. The lack of standardization in cell culture protocols causes difficulties for comparability and reproducibility of data. As such, a deeper understanding of differentiation conditions would allow for a more consistent application across C2C12 cell culture studies.

Abstract ID: 1D-6*

THE SYNERGISTIC IMPACT OF HUMAN TRNA MODIFICATIONS: A MOLECULAR DYNAMICS SIMULATION STUDY

Mark J. Lea, Stacey D. Wetmore
University of Lethbridge

Transfer RNA (tRNA), the translational adaptor molecule, is post-transcriptionally modified by the formation of structurally diverse chemical adducts on its nucleosides. The occurrence of tRNA modifications is observed across all domains of life, attesting to their evolutionary significance. These translationally relevant modifications occur at a relatively high frequency and diversity within the anticodon stem-loop (ASL). They are also formed in an organized fashion, where the presence of one modification acts as a recognition element for the following modification. This modification network produces a synergistic effect, a lack of which is correlated to pathological consequences ('RNA modopathies'). For example, the relationship between aberrant ASL modifications and the human neurological disorder non-syndromic X-linked intellectual disability has been studied for $tRNA^{Phe}$(GAA). Neural development genes are highly TTT-biased, and proper modification of $tRNA^{Phe}$(GAA) is suggested to be essential for reading frame stabilization of UUU mRNA codons. Human $tRNA^{Phe}$(GAA) ASL modifications occur in a hierarchical order: first 1-methylguanosine, followed by 2'–*O*–methylcytidine, 2'–*O*–methylguanosine and finally hypermodification of 1-methylguanosine to peroxywybutosine. Although many functions of modifications have been proposed, their exact biological roles are currently unclear. In the present work, ten replicates of 500 ns molecular dynamics (AMBER) simulations were performed for six ASL models representing the stages of $tRNA^{Phe}$(GAA) modification. By providing the structural information for the order, cross-talk and synergistic impact of the human $tRNA^{Phe}$(GAA) modification network, this work expands our understanding of the important roles of tRNA modifications in preventing human disease.

Session 1E | Health Sciences and Statistics | May 5th 1:45 to 3:15 pm

Abstract ID: 1E-1

SURVIVING THE NARRATIVE - EXPLORATORY RESEARCH ON LGBTQ+ SURVIVORS OF VIOLENCE IN THE MEDIA: A REFLECTION AND CREATIVE RESPONSE

Janine Heber
MacEwan University

Media representations and the stories we are told on screen have the power to shape societal perceptions of marginalized identities. Violence towards queer and trans people is often exploited in TV and films. This multidisciplinary research project explored portrayals of LGBTQ+ (Lesbian, Gay, Bisexual, Transgender, Queer or questioning and more) survivors of violence in the media. A sample of 28 characters from TV and films was collected to test the hypothesis that queer written or own voice narratives have more positive endings for LGBTQ+ victims of violence. This study built on previous research by Kaneda (2021) which found a relationship between own voice-written narratives and positive sapphic representations in the media. In response to the current media analysis, an embroidery hoop and song were created to explore research themes and reflections. It is vital to challenge cis-normative and heteronormative understandings of violence to hold space for queer and trans experiences of violence in the anti-sexual violence movement.

Abstract ID: 1E-2*

EXPLORING POTENTIAL RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND SOCIAL WELLBEING, AND VARYING PRACTICES OF SEDENTARY BEHAVIOUR IN OLDER ADULTS

Alex Engel
University of Lethbridge

Sedentary behaviour and the health risks it poses have grown exponentially over the past 2 years during the COVID-19 pandemic. Psychological health, well being, social interaction, fatigue, and activity levels are all areas of concern that have become more prominent with increased sedentary behaviour. Research has demonstrated that high sedentary behaviour rates and these health risks are more prevalent in the older adult population. The purpose of this proposed study is to examine relationship between components of mental, physical, and social health, and varying practices of sedentary behaviour among older adults from data collected during the pandemic. It is hypothesized that older adults with higher levels of sedentary behaviour are more likely to report lower scores for emotional well being, social functioning, satisfaction with life, and increased scores for fatigue. Additionally, it is hypothesized that sedentary behaviour that are not as mentally stimulating (e.g., watching TV) will report strong negative correlations with optimal health outcomes in comparison to stimulating forms of sedentary behaviour (e.g., socializing). Approximately 250 participants aged 65 years or greater completed a self-report online survey. Analysis will be done to compute descriptive statistics and bivariate correlations. The potential relationships presented in this study could provide further information into the health concerns involving different practices of sedentary behaviour in an aging population.

Abstract ID: 1E-3

MODELLING THE FLOW OF PATIENTS WITH SUBSTANCE MISUSE THROUGH THE EMERGENCY DEPARTMENT

Jonah Edmundson
The King's University

Emergency departments (EDs) are an indispensable health care service for Canadians from all walks of life. Central to the effectiveness of EDs is their ability to deliver timely care in urgent situations. One population of Canadians for which EDs are especially vital are those presenting with substance misuse. In order to identify potential barriers to rapid delivery of care for this patient subset, we investigated their ED flow characteristics using a multi-state modelling approach. All patient presentations for substance misuse in Alberta for the 2019 fiscal year were extracted from a population-based provincial dataset. A model with seven mutually exclusive states (such as start of ED presentation, physician initial assessment, etc.) was developed. Characteristics that influenced how quickly patients moved from state to state were examined. Key variables that were associated with transitions among states included patient municipality type, triage score, crowding level and diagnostic code. The findings present a more nuanced analysis of the factors that influence the flow of patients presenting with substance misuse issues through the ED.

Abstract ID: 1E-4

STORYTELLING ABILITIES OF CHILDREN WITH COCHLEAR IMPLANTS

Nicole Walklin
MacEwan University

The purpose of the present study is to compare the storytelling abilities between children with cochlear implants (CI) and normal-hearing children (NH). This creative delivery combines both linguistic and cognitive skills, acting as a valid assessment of the child's social-communicative development. Insight into the macro and microstructure level features of CI children's stories can reveal aspects of a child's language grammar development. CI children's storytelling abilities, along with NH peers, were assessed in topics on personal events (autobiographical memory) and in topics on scripted novel events (semantic memory). The child selected a story topic among four options then told a story in relation to the topic, creating a total of four stories. Audio recordings allowed the researchers to later transcribe verbatim and analyze wherein three quantitative scores were assigned for each story: an overall structure score, a cohesion score (conjunctions), a cohesion score (referents), resulting in a total narrative ability score (Crosson & Geers, 2001). Preliminary analyses reveal improvements with story-telling abilities with age and experience with CI devices. The findings will assist parents, educators, and practitioners in developing strategies that can optimize CI children's language outcomes through creative language activities.

Crosson, J., & Geers, A. (2001). Analysis of narrative ability in children with cochlear implants. *Ear & Hearing*, 22, 381-394.

Session 1F | Biology | May 5th 3:45 to 5:55 pm

Abstract ID: 1F-1

CRACKING THE MYSTERY OF DORMANCY: TREATMENTS TO PROPAGATE NATIVE VS NON-NATIVE STONESEED SPECIES

Carisa McGale
University of Lethbridge

Propagation knowledge is required to re-establish plant populations, however a barrier to successful reintroductions is the lack of published protocols for propagating rare, native plant species. For example, there is no published propagation protocol for American gromwell (*Lithospermum latifolium* Michx.), a rare woodland plant found in southern Ontario. Overcoming seed dormancy may require cold stratification, physical scarification, or both. I tested the effect of 3 different seed pre-treatments on the germination rates of American gromwell seeds: cold moist stratification only (control), cold moist stratification plus clipping the seed coat, and cold moist stratification plus a hot water boil. I also tested the effect of these treatments on the germination of European gromwell (*Lithospermum officinale*), an introduced species closely related to American gromwell. I also tested whether seed size affects germination and growth rates. I predicted that seeds of the cold moist stratification plus scarification treatment would have the highest germination rates. I also predicted that larger seeds would have the highest germination and growth rates. Only one American gromwell seed germinated, in the control treatment. European gromwell had 86% germination within the control, 45% with cold stratification plus clipping, and 0% germination with cold stratification plus hot water. The control treatment of the European gromwell germinated faster and had more germinants than the other treatments. The low germination rate for American gromwell may be explained by unviable embryos, or it may be that two periods of cold stratification are required.

Abstract ID: 1F-2*

THE WARBLING VIREO COMPLEX: A MIGRATORY DIVIDE

Antoine Hebert Breton, Soniya Bashyal
St. Mary's University

A migratory divide occurs when two populations of the same species breed in the same area but use different routes to get there. In our study, we examined the migration patterns of the two subspecies of the Warbling Vireo Complex: the Eastern Warbling Vireo (*Vireo gilvus)* and Western Warbling Vireo (*Vireo swainsonii)*, to determine if there is an existing migratory divide between these two subspecies. We analyzed the data from database ebird and Royal Museum to determine the spring arrival and fall departure times of the two subspecies. We then used unpaired two sample t-test to determine if there is a significant difference between the means of their spring arrival times, and between their fall departure times. The p-value of the unpaired two sample t-test was 1 for the Spring arrival times, and < 2.2e-16 for the fall departure times between the two subspecies. Our results indicate that while there is no significant difference in the spring arrival times, there is a significant difference in the fall departure times between the two populations. Therefore indicating that while both birds arrive at their breeding grounds at similar times, they depart at different times. This suggests that the birds are taking different migratory routes to get to their wintering locations, and thus are departing their breeding grounds at different times, indicating an existing migratory divide between the two populations. Therefore, we conclude that there is an existing migratory divide between the Eastern and the Warbling Vireo.

Abstract ID: 1F-3*

EFFECTS OF HOST PLANT QUALITY AND MICROSPORIDIAN INFECTION ON FOREST TENT CATERPILLAR, *MALACOSOMA DISSTRIA* HÜBNER (LEPIDOPTERA: LASIOCAMPIDAE) PERFORMANCE AND DISEASE SUSCEPTIBILITY

Taylar Whidden
MacEwan University

The cyclic population dynamics of forest tent caterpillar (FTC) (*Malacosoma disstria* Hbn.) (Lepidoptera: Lasiocampidae) are driven by a variety of factors including delayed-density dependent mechanisms such as disease. We measured the performance and microsporidia infection load of FTC when reared on four different diets, including trembling aspen foliage (*Populus tremuloides* Michx.), sugar maple foliage (*Acer saccharum* Marshall), a standard artificial diet, and an artificial diet fortified with lyophilized trembling aspen foliage to determine if diet interacts with microsporidia infection to alter FTC performance and their susceptibility to infection. There were no interactive effects between diet and microsporidia infection on adult performance of FTC, but diet affected FTC susceptibility to infection. Adult FTC had lower rates of infection when reared on fresh aspen foliage or an aspen-fortified artificial diet, compared to the other diet types. While diet and microsporidia infection do not interact to effect adult FTC performance, they may interact to effect larval performance as susceptibility to microsporidia infection varies by diet. The findings of this study help to increase our understanding of how disease and plant quality effect FTC and ultimately their population dynamics. Additionally, this study provides more information on tri-tropic interactions involving disease.

Abstract ID: 1F-4

SAVING THE ALBERTA HONEYBEES: DENTIFICATION AND CHARACTERIZATION OF *PAENIBACILLUS LARVAE* BACTERIOPHAGES FOR THE TREATMENT OF AMERICAN FOULBROOD IN ALBERTA HONEYBEES

Shaina Selles, Heather Prior
The King's University

American Foulbrood disease (AFB), caused by the spore forming bacterium *P.larvae*, is one of the most widespread and devastating larval honeybee diseases. Sporulation has made prevention and treatment strategies in the past challenging, and there has been increasing concern of antibiotic resistance in bacterial strains and antibiotic residues in hive products. This research aims to determine the effectiveness of lytic bacteriophages as an alternative treatment and prevention strategy for AFB in Alberta, focusing on province-specific phages that have persisted along with the bacterium for over a decade. The goal of this study was threefold: 1) Using PCR based methods, extracted phage DNA samples (2008 and 2021) from Alberta infected scale were screened for bacteriophages 2) PCR identification measures including restriction digests and sequencing, to confirm the identities of bacteriophages and 3) Examination of lytic abilities against *P.larvae* strains. We were successful regarding detecting, characterizing and lytic testing with 3 phages from 2008: Wanderer, Sitara, and Arcticfreeze/Bloom/DevRi. However, characterization of 2021 phage requires additional effort. It is hypothesized that phage identities over this temporal period and region have remained the same, however further work should help to confidently prove the persistence of *P.larvae* phage. The ultimate goal will then be formulating a bacteriophage cocktail for use by Alberta beekeepers in preventing and treating AFB.

Abstract ID: 1F-5

DEVELOPING MICROSATELLITE MARKERS FOR C*YPRIPEDIUM PASSERINUM*

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MacEwan University

In the age of the Anthropocene, there has been a steady and exponential decline in global plant biodiversity leading to an increase in conservation efforts. Key to an effective conservation strategy is an assessment of the genetic diversity of the vulnerable population. One of the tools to assess genetic diversity is microsatellites. Microsatellites are a type of tandem repeat found in the DNA of all eukaryotes that have proven useful in assessing genetic diversity because of their genomic abundance, high mutation rate, and resulting high levels of polymorphism. This project aimed to develop microsatellite markers for the endangered orchid, *Cypripedium passerinum*, to elucidate genetic variation in populations within the Wagner Natural Area in central Alberta. Fast Isolation of AFLP Sequences Containing Repeats (FIASCO) was used to generate three different microsatellite-enriched libraries using AC, AT, and AAG probes. 126 and 98 clones have been sequenced from the AC and AT libraries, respectively. From the AC library, 20 primer pairs have been developed with 3 successfully demonstrating amplification from *C. passerinum* genomic DNA templates. 29 primer pairs have been developed for the AT library, of which 17 have been shown to successfully amplify *C. passerinum* genomic DNA. Primer pairs successfully amplifying *C. passerinum* DNA will be used to detect polymorphisms within the *C. passerinum* population at the Wagner Natural Area. This project's findings will contribute to the existing knowledge and conservation of *C. passerinum* within and outside of the Wagner Natural Area.

Keywords: *Cypripedium passerinum*, Microsatellites, Genetic Diversity, Orchids

Abstract ID: 1F-6

ZEBRAFISH IMPRINT TO AN AMINO-ACID MIXTURE

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Animals constantly receive sensory information from their environments which dictate their behavior. Olfaction (smell) is a particularly important sense influencing how animals find food, avoid predation, and mate. How an animal perceives environmental stimuli is influenced by their early-life environment, some animals imprint to odorants found in their environment forming long-lasting memories during a brief sensitive window during early development. This imprinting effect influences how animals behave in the presence of an imprinted odor when encountered in future life stages. My project aims to determine whether larval zebrafish imprint to an amino-acid mixture during their early development given that they utilize olfaction of amino-acids to dictate their behavior. This will be assessed by observing how adult zebrafish behave in response to this same amino-acid mixture as fully grown adults and comparing the resulting response to zebrafish that were not imprinted to the amino-acid mixture. If evidence of imprinting behavior is found, I will then examine zebrafish behavior in response to each individual amino-acid within the imprint mixture to determine if they imprinted to the amino-acid mixture as a whole (configurative imprinting), or to the individual components within the mixture (elemental imprinting). To date, I have established that zebrafish do imprint to an amino-acid mixture consisting of L-Leucine, L-Valine, and L-Lysine. I predict that zebrafish will imprint to the entire mixture rather than to each/one amino-acid within the mixture.

KEYWORDS: Olfaction, Zebrafish, Imprinting, Behavior

Abstract ID: 1F-7

CHARACTERIZING FERTILITY AND REPRODUCTIVE DEVELOPMENT IN *ARABIDOPSIS* AUXIN TRANSPORT MUTANTS

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Developmental processes in plants are complex, highly regulated, and involve various structures and stages of growth. The proper development of reproductive structures, which are enclosed in the flower, is particularly significant because successful reproduction is required for supporting fecundity and genetic diversity. Many critical developmental processes require the production and transport of the plant hormone auxin. Auxin movement within a cell is controlled by a family of plant-specific PIN-FORMED (PIN) proteins. Together, PIN proteins and auxin both play an important role in the correct development and production of seed. We examined different genetic lines of the model plant species *Arabidopsis* that have gene mutations resulting in defects to PIN protein localization, auxin transport, and decreased seed production. However, the specific reproductive process(es) that is/are affected in these mutant lines contributing to lower seed set remains unknown. We examined the pollen and anthers (male structures), as well as carpels and ovules (female structures) for developmental defects. We also examined the interaction of the male and female structures during fertilization by conducting cross-pollination experiments. We identified defects that likely involve female reproductive structures and will conduct gene expression analyses to corroborate these findings and attempt to identify the underlying molecular mechanisms. Plant sexual reproduction is critical to crop productivity and food production. Consequently, it is important to understand the cellular events leading up to successful fertilization and seed development so that this knowledge can be applied to plant biotechnology and breeding programs addressing critical issues such as our growing global population.

Session 1G | Health Sciences | May 5th 3:45 to 5:05 pm

Abstract ID: 1G-1

SEX DIFFERENCES IN THE PREVALENCE OF MBI DOMAINS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction: Mild behavioral impairment (MBI) is an early indicator of dementia risk characterized by the later life onset of persistent changes in behaviour or personality. An under-investigated feature of MBI is the difference in symptoms and risk based on sex. This systematic review and meta-analysis investigates sex differences in of MBI prevalence.

Method: EMBASE, MEDLINE, PsycINFO and the gray literature were systematically searched for articles mentioning MBI, excluding participants with dementia. Abstracts and full-text articles were screened by two independent reviewers and included if sex-specific prevalence data were reported. A standardized data extraction sheet collected demographics, cognitive diagnosis, and prevalence of females within each MBI domain. A random-effects meta-analysis was performed to identify pooled prevalence.

Result: From the initial search, 5476 articles were retrieved, and 3435 papers remained after deduplication. After full-text screening, 35 papers were selected for data extraction. In normal cognition, four of five MBI domains were more prevalent in males (decreased motivation, impulse dyscontrol, social inappropriateness and abnormal perception). In mild cognitive impairment, three of five domains were more prevalent in males (decreased motivation, impulse dyscontrol, and abnormal perception). However, in the mixed cognitive category, four of five domains were more prevalent in females (decreased motivation, emotional dysregulation, impulse dyscontrol and social inappropriateness).

Conclusion: Sex differences in prevalence of MBI domains varied by baseline cognitive status. These findings suggest potential sex-specific trajectories of MBI symptoms across the cognitive spectrum and highlights the need to further explore sex differences in MBI.

Abstract ID: 1G-2*

THE IMPACT OF ACUTE EXPOSURE OF (+)-ALPHA-PINENE ON ZEBRAFISH (*DANIO RERIO*) ANXIETY-LIKE BEHAVIOUR, BOLDNESS, AND LOCOMOTION

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MacEwan University

Terpenes are phytochemicals that provide plants with their aroma and are composed primarily of monoterpenoids, containing a 10-carbon backbone, and sesquiterpenoids, which contain a 15-carbon backbone. In marijuana specifically, the therapeutic value of terpenes are being increasingly explored in the research community due to their reported health benefits such as anticancer, antimicrobial, antifungal, antiviral, antihyperglycemic, analgesic, anti-inflammatory, and antiparasitic effects. Our study explored the dose-dependent effect of three different concentrations of (+)-alpha-pinene (0.01%, 0.02% and 0.1% concentrations) on zebrafish (*Danio rerio*) behaviour. Anxiety-like behaviour, boldness, and locomotion were assessed using the open field test followed by the novel object approach test. In the open field test, the 0.02% (+)-alpha-pinene group showed the greatest reduction in anxiety-like behaviour relative to controls. There was also a significant decrease in locomotion of the 0.01% and 0.02% (+)-alpha pinene dosing group. In the novel object approach test, we found minimal alterations in anxiety-like behaviour and boldness in the three (+)-alpha pinene groups and observed the greatest alterations in locomotion in the 0.02% dosing group. Interestingly, we observed no significant alterations in the anxiety-like behaviour, boldness, and locomotion of the 0.1% group during both tests.

Abstract ID: 1G-3*

INHIBIT: INATTENTION, HYPERACTIVITY, AND IMPULSIVITY THROUGH BRAIN STRUCTURE AND INHIBITION

Susana Puche Saud, Kayla D. Stone, Sneha Chenji, Rose M. Swansburg, Frank P. MacMaster
University of Calgary

Background: Response inhibition is the ability to inhibit an instinctive response. It can be evaluated with the stop signal task (SST). The right superior frontal gyrus (rSFG) is involved in response inhibition and has been found to be thinner in people displaying inattentive, hyperactive, and impulsive (InHI) behaviors. These are common symptoms in inhibitory control disorders. The SST has participants inhibit a split-second response that is already in motion, and people showing clinically high InHI behaviors tend to perform poorly on this. Despite this connection, the relationship between rSFG cortical thickness and SST performance (via accuracy and stop signal reaction time (SSRT)) has yet to be studied in children.

Methods: The Adolescent Brain Cognitive Development (ABCD) Data Repository was used to access SST, CBCL Attention Problems Scale (for quantifying InHI behaviours), and rSFG cortical thickness (anatomical) data (N = 7,542). Three linear regressions were performed to determine if InHI behaviors and SST performance predict rSFG cortical thickness. A one-way ANCOVA was performed to compare cortical thickness and SST performance between children showing no InHI behaviors, clinically high InHI behaviors, and those in between. Statistical significance was accepted at $p < .05$.

Results: Higher CBCL Attention Problems Scale score and lower SST accuracy predicted lower cortical thickness in children showing these behaviors, and SSRT differed between kids showing InHI behaviours to different extents.

Conclusion: More InHI behaviours and lower SST accuracy (but not SSRT) predict a thinner rSFG. Additionally, higher-frequency InHI behaviors were associated with longer SSRT.

Abstract ID: 1G-4*

THE EFFECTS OF CBD ON AGE-RELATED COGNITIVE DECLINE IN MICE

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A major upcoming health concern will be age-related dementias such as Alzheimer's Disease (AD). Normal aging without a neurodegenerative disease like AD can also cause cognitive decline in human and non-human animals. Learning and memory function associated with the hippocampus (HPC) and related neural circuits deteriorates with normal aging. No current pharmacological treatments can stop or slow the progression of age-related dementia, but cannabinoids have shown promise in targeting various pathologies associated with brain aging. The cannabis component Cannabidiol (CBD) is an appealing candidate because it demonstrates anti-inflammatory, neuroprotective and antioxidant properties that can delay age-related neurodegeneration. The endocannabinoid system appears to influence the aging process however, it is not understood how CBD impacts normal brain aging.

Hypothesis: Oral CBD will decrease age-related cognitive decline and associated neuropathology.

Methodology: Aged C57 mice were given CBD treatments daily starting at 14 months and tested at 19 months. Testing included behavioural tasks to measure the function of different brain structures and memory types including spatial, object, fear, and motor function. Tasks included Morris Water Task (MWT), Novel Object Recognition (NOR), Fear Conditioning (FC), and Balance Beam (BB) respectively.

Results: CBD had a dramatic effect on hippocampal function, improving spatial memory retention during MWT. Importantly, CBD had no other negative effects on the aged mice. These preliminary findings provide insight into the effects of CBD on normal aging. Further work will assess the aged brains with immunohistochemistry imaging to evaluate the associated deterioration of the aging brain and the impacts of CBD treatments.

Abstract ID: 1G-5*

NOVEL 5-HT_{2A}R AGONIST DECREASES AB PLAQUE DEPOSITION AND MICROGLIA ACTIVATION IN APP^{NL-G-F} MOUSE MODEL OF ALZHEIMER'S DISEASE

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Background: In recent years there's been a surging interest in the pharmacological benefits of psychedelics. These hallucinogens target and aid the serotonergic (5-HT) system, most specifically by binding to the 5-HT_{2A} receptors (5-HT_{2A}Rs). This process has been proven to ameliorate the conditions of many psychiatric conditions, one of them being Alzheimer's disease (AD). Hypotheses for these 5-HT agonists regard their effects on neurogenesis and Amyloid-Beta (A) plaque deposition, one of the biomarkers of Alzheimer's.

Objective: This study shows the effects of the drug (4-Bromo-3,6-dimethoxybenzocyclobuten-1-yl)methylamine hydrobromide (TCB-2) as a candidate to treat AD pathology in the APP^{NL-G-F} mouse model at the stages of 6 and 10 months of age.

Methods: 14 APP^{NL-G-F} mice were treated with either 5 mg/kg of TCB-2 or 0.25 g of vehicle (Nutella®) every 3 days for the length of 30 days. Afterward, they were tested on the Novel Object Recognition (NOR) task for 6 days and subsequently perfused to collect and analyze their brains.

Results: The TCB-2 treatment provided no supplementary aid against the advancement of AD neuropathology at both stages. Therefore, this dose of the drug had no significant effects on either HPC volume or A proliferation. However, the 6mo group showed a significantly higher Discrimination Index (DI) compared to the 10mo group in the NOR task following treatment.
Conclusion: With their psychoactive effects as a topic of conundrum among both specialists and commonfolk, these results serve the purpose of educating and expanding the literature on the topic of psychedelics as drugs to treat AD.

Abstract ID: 2A-1*

HIPPOCAMPUS ACTIVITY ASSOCIATED WITH BEHAVIOURAL PERFORMANCE IN RAT'S SINGLE-PELLET REACHING TASK

Nik Josafatow, Dr. Masami Tatsuno
University of Lethbridge

Recent electrophysiological findings suggest that the sleeping brain reactivates memories of recent events to consolidate learning. The consolidation process for declarative memory can be enhanced via targeted memory reactivation (TMR) – delivering a stimulus (typically a tone or scent) during task learning, and again during sleep. The role of the hippocampus (HC) in procedural memory is debated. In this study, I analyzed local field potentials (LFPs) data that were obtained previously from four groups of rats (n = 5-6 each) during a 12-day training period on a single-pellet reaching task (Whishaw and Pellis, 1990). One experiment group received tone-delivery TMR during REM sleep prior to the task (pre-task REM experiment), and another received the TMR during SWS after the task (post-task SWS experiment). The control groups paralleled the experiment groups with the exception that the tones delivered during sleep were not paired with tones during the task. There were more rapid learners in the pre-task REM groups, suggesting that tone delivery during REM sleep prior to the task is linked with rapid task learning. However, as the learning-rate differences between experiment and control groups were negligible, TMR delivered as per the current design may not be an effective means of improving rat skilled reaching learning. By power and coherence analyses on LFPs from the motor cortex (CTX) and HC I also found that LFP power of the HC most closely correlates to motor task performance, which suggests that the HC is indeed involved in learning of rat's single-pellet reaching task.

Abstract ID: 2A-2*

THE EFFECTS OF 15HZ INFRASOUND ON WILD-TYPE ZEBRAFISH ANXIETY BEHAVIOUR

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Many aquatic species have been shown to be sensitive to infrasound – sub-20Hz frequencies below the human hearing threshold – commonly eliciting anxiety-like behaviours. Wild-Type Zebrafish, *Danio rerio*, have been shown to be a promising model organism of anxiety behaviour in behavioural neuroscience and a similar response could expand their utility in future studies on the anxiogenic effects of infrasound. Because such frequencies have been found to be emitted by marine human infrastructures, such as marine wind turbines and diesel engines, such a model would be highly useful in evaluating the potential for infrasound pollution on aquatic ecosystems. Infrasound could also be useful as a non-invasive environmental stressor in future behavioural studies on anxiety using zebrafish. This study aimed to evaluate *Danio rerio* as a model organism for testing the anxiogenic effects of infrasound frequencies on aquatic life. An open field test using motion tracking technology was used to measure changes in anxiety behaviour under infrasound conditions and frequency tones of 15Hz were found to produce significant anxiety behaviour in adult naïve zebrafish – not found in any other treatment, habituation, or control conditions. 15Hz infrasound elicited anxiety-like changes in arena location preference, with 15Hz group zebrafish showing no location preferences during habituation but moving away from the infrasound speaker during infrasound treatment. These findings established that *Danio rerio* are an appropriate model organism for studying the anxiogenic effects of infrasound on aquatic life.

Abstract ID: 2A-3*

TRANSGENERATIONAL PRENATAL STRESS ALTERS NEURODEGENERATIVE DISEASE PATHWAYS IN THE FETAL CORTEX AND PLACENTA

Nicola A. Schatz[1], Stephanie E. King[1,3], Olena Babenko[1,2], Yaroslav Ilnytskyy[2], Igor Kovalchuk[2,3], and Gerlinde A.S. Metz[1,3]

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Prenatal stress can increase the susceptibility to neurological diseases in a sex-specific manner. Changes in placental function from prenatal stress can impact neurodevelopment and diseases of the brain potentially through transgenerationally heritable changes in the transcriptome. The objective of this study was to investigate the sex-specific effects of transgenerational prenatal stress on pathways linked to neurodegenerative diseases in the brain and placenta across four generations of rats. The parental (F0) generation rats were exposed to stress during gestational days (G) 12-18. The transgenerational lineage was bred to the F3 generation without further stress exposure. Control and transgenerational stress lineage fetuses and placentas were collected at G21 from males and females. Transcriptome analysis was performed on the fetal cortex and placenta of the F1-F3 generations. About 41-46% of the differentially expressed genes overlapped between the cortex and placenta in both males and females with similar levels of fold change. Pathway analysis identified several common genes between the cortex and placenta that have vital in the etiology of neurodegenerative disease. Both datasets appeared to have genes involving alterations to pathways vital for mitochondrial function. Males appeared to have more altered genes in pathways that in humans are connected to Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis (ALS). The overlap in transcriptomic changes related to neurodegenerative diseases between the placenta and fetal cortex suggest that the placenta may be used as a potential biomarker source to predict sex-specific molecular changes in the brain correlated with neuropathologies in adulthood.

Abstract ID: 2A-4*

EFFECTS OF CANNABINOL EXPOSURE DURING EARLY DEVELOPMENT ON ZEBRAFISH ESCAPE RESPONSE

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Cannabis is a commonly used drug and its use is increasing. There are concerns about the effects of cannabis use during pregnancy on the embryo's health. From previous experiments, exposure to cannabis or its metabolic by-products, including cannabinol (CBN), during early development affects neural and motor development. This experiment specifically investigates the effects of CBN exposure on auditory and mechanical escape response early in development. Zebrafish were exposed to varying concentrations of CBN immediately after egg fertilization until 24 hours post fertilization. At 5-days post fertilization (dpf), embryos were placed in an open field under a microscope and presented with an acute auditory stimulus. At 2 dpf, embryos were placed in an open field and presented with a mechanical stimulus. High escape response rates indicate functioning sensory hair cell and motor neuron development.

Given the previous findings of CBN-induced alterations to sensory hair cell and motor neuron development, it was expected in both experiments that zebrafish will display altered escape responses to the respective stimuli. At 5 dpf, CBN-exposed zebrafish showed a significant decrease in response rate compared to controls. At 2 dpf, CBN-exposed zebrafish showed no significant differences in response rates. These results are important in further understanding and characterizing the effects of cannabis on neural development. While much research has focused on other compounds in cannabis, including tetrahydrocannabinol (THC) and cannabidiol (CBD), comparatively little work has focused on CBN. This topic is of growing importance; as cannabis use increases, the potential for use during pregnancy also increases.

Abstract ID: 2A-5*

AN ALTERATION OF LOCOMOTION IN ZEBRAFISH FROM EXPOSURE TO THE TERPENE (-)-α-PINENE

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With the legalization of cannabis in Canada there is an increased focus on genetic strains and chemical compounds in cannabis. Terpenes are aromatic compounds found in cannabis and other plants that could have medicinal value. A terpene found in cannabis and other products is α-pinene. This study used (-)-α-pinene to examine locomotion, anxiety-like behaviour, and boldness in zebrafish (*Danio rerio*) using a motion-tracking software system. The four experimental groups included a control, and (-)-α-pinene groups at 0.01%, 0.02% and 0.1% (~n=15 each) and each fish was exposed for 10 minutes prior to being placed in the open field test and then the novel object approach test. The time in virtual zones in the arena, distance moved, velocity, meandering, high mobility and immobility of the fish were quantified. There was a significant difference observed between the control and 0.1% group in distance moved, velocity and high mobility in both tests. A significant difference was also found between the control and 0.1% group in time spent between virtual zones in the open field test. No significant differences were found in the other parameters and groups. Our results suggest that certain concentrations of (-)-α-pinene may reduce anxiety-like behaviours in zebrafish and impact their locomotion. This research will be used to supplement previous findings as well as inform future research regarding the impacts of different terpenes.

Abstract ID: 2A-6*

EXAMINING THE ANXIOLYTIC POTENTIAL OF CANNABIS TERPENES: THE ACUTE EFFECT OF BETA-CARYOPHYLLENE ON ZEBRA-FISH ANXIETY-LIKE BEHAVIOUR

Andréa Johnson
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Terpenes found in the *Cannabis sativa* plant have emerged as a potential therapeutic compound following the significant health benefits found in cannabis phytocannabinoids, such as delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). Terpenoids form the essential oils of plants and flowers and are responsible for their varying aromas, flavours, and colours. More specifically, there is a vast diversity of terpenoids found in glandular trichomes of the inflorescence of the female cannabis plant that vary within and across the many different strains. Recent research has found terpenoid compounds to have potential medicinal properties including, but not limited to, anti-inflammatory, anti-epileptic, anticancer, anxiolytic and antidepressant effects. The present study investigated the acute dose-dependent effects of a common terpene found in cannabis, Beta-Caryophyllene, *on zebrafish anxiety-like behaviour.* Zebrafish share a 70-80% homology with the human neuroanatomy system and make a practical model in the study of neurobiology and new drug research. Beta-Caryophyllene was administered in four concentrations: 0.02%, 0.2%, 2.0%, and 4.0%. Zebrafish behaviour was then tracked and analyzed in two common paradigms used to measure anxiety-like behaviour: the open field exploration test and the novel object approach test. Variables of interest that were analyzed included the duration of time spent in the inner and thigmotaxic zones, swimming velocity, and the duration of time spent immobile. Although Beta-Caryophyllene has been shown to have anxiolytic effects in previous animal studies, the present study did not find any significant effects on zebrafish behaviour across the variables analyzed.

Abstract ID: 2A-7*

MOSSY FIBER STRIPES IN THE DEVELOPING MOUSE CEREBELLUM

Merry Faye Graff
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The cerebellum, located at the back of the brain, facilitates balance and the coordination of motor movements. It aids in everyday tasks such as walking in a straight line or reaching for your coffee cup. The cerebellar cortex is composed of a complex network of neurons called Purkinje cells (PCs) that are modulated by afferent input from other regions of the brain. One intriguing aspect of this network is that PCs and their inputs are arranged in vertical stripes; specific mossy fiber axons align with specific PC populations, establishing a zebra-like striping pattern. While these stripes are anatomically fascinating, the functional reason for their presence and how these patterns are formed remains unclear. To better understand the relationship between afferent projections and PCs, we looked at how this stripy pattern forms during development. Using immunohistochemistry, we mapped the expression of proteins in PCs and mossy fibers of the mouse cerebellum from birth through to adulthood. Our preliminary data suggests that mossy fibers arrive in the cerebellum around birth and appear to be patterned by molecular cues (likely provided by PCs) that align them into stripes.

Abstract ID: 2B-1*

THE ATTACHMENT OF A NUCLEAR LOCALIZATION SIGNAL AND A PEROXISOME TARGETING SIGNAL TO MCHERRY AND THE EFFECT ON THE LOCALIZATION OF MCHERRY IN AN MDA-MB-231 CELL LINE

Gina Friedrich
Concordia University

While target peptides themselves have been studied widely, dual targeting and prioritization of signals in cellular trafficking is relatively unstudied. The goal of this experiment was to determine the localization of a mCherry protein that contains both a nuclear localization signal (NLSSV40) and a peroxisome transit signal (PTS1) in an MDA-MB-231 cell line.

Oligonucleotides were designed for each target peptide that contained the sequence for the target peptide and a restriction enzyme site for confirming the clones. They were allowed to anneal, leaving overhangs that corresponded with restriction site overhangs in the multiple cloning site and in the mCherry protein coding sequence. The two target peptides were added to opposite ends of the protein. The annealed oligonucleotides were added to the digested plasmids and ligated. The MDA-MB-231 cell line was transfected with the plasmids and stained with DAPI and a peroxisome labeling kit to visualize the localization of mCherry in the cells.

As of right now, both the plasmid containing NLSSV40 and the one containing PTS1 have been successfully cloned. The next steps in this research are to confirm the efficacy of the individual target peptides, clone the NLSSV40 and PTS1 target peptides into one plasmid, and to express the protein in a MDA-MB-231 cell line. This will be done by digesting both plasmids in the same places and ligating the portions that contain the target peptides together. This research can help improve the understanding of eukaryotic cellular processes overall, more specifically with the targeting of proteins to different organelles.

Abstract ID: 2B-2

BIOPHYSICAL ANALYSIS OF AN UBIQUITIN LIGASE COMPLEX ASSOCIATED WITH BREAST CANCER

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The breast cancer associated protein, BRCA1, interacts with the BRCA1 associated protein, BARD1, through their RING domains to form a heterodimer which can act as a E3 ligase. This stable heterodimer influences a number of cellular processes that maintain genomic stability by promoting the homology-directed repair during double strand break. Mutations in the RING domains cause disruption of the ligase activity which have implications in the promotion of tumor progression, as well as can pose a risk for breast cancer in women. A high resolution three-dimensional structure of the human BRCA1-BARD1 RING domain heterodimer is not available.

With an aim to obtain crystal structure of the above heterodimer, we got the genes corresponding to the two partners in the Duet expression system. Further we optimized the purification protocol for the heterodimer. The purified protein complex was assessed using SDS-PAGE. In order to validate the stability of the complex in different buffer systems, we performed thermal shift assay. Buffer system demonstrating highest Tm value was selected as the buffer of choice. Further the integrity of the heterodimer was assessed on a size exclusion column assisted with multi-angle light scattering detector. The crystallization screen trials were performed using Art Robbins robot. Initial crystal hits were assessed for diffraction using in house diffractometer.

Currently, we are moving forwards to obtain a high-resolution map of the complex. This structure will contribute to a more comprehensive database of mutations in the complex and allow for better prediction for breast cancer risk.

Abstract ID: 2B-3

EXPRESSION AND PURIFICATION OF A NOVEL BACTERIOCIN FROM *CORYNEBACTERIUM JEIKEIUM*

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Bacteriocins are peptides that are ribosomally synthesized by bacteria and are commonly used as antimicrobials in food and animal industries. This project focuses on the isolation of a putative novel bacteriocin, CojA, produced by *Corynebacterium jeikeium*. CojA was previously identified through genome mining and has the potential to be active against antibiotic-resistant strains of *C. jeikeium*. For this project, the *cojA* gene was cloned in a pET-SUMO vector, and *Escherichia coli* was transformed with the pET-SUMO-CojA plasmid. Expression and purification of SUMO-CojA using nickel affinity chromatography were performed. SUMO protease was used to cleave the SUMO tag, and sodium dodecyl sulfate-polyacrylamide gel electrophoresis was performed to monitor the cleavage step. Bioactivity assays are underway to confirm the antimicrobial activity of CojA.

Abstract ID: 2B-4

PURIFICATION AND CHARACTERIZATION OF A MALTOTRIOSE RELEASING ENZYME FROM *MICROBULBIFER THERMOTOLERANS*

Jenna Sullivan
University of Lethbridge

Sugars play a huge role in the cell by providing energy for an organism's activities. Recently, researchers have become more interested in studying carbohydrates and their role in modifications of proteins, lipids, and nucleic acids. Establishing a quick and easy method to produce small simple sugars will help carbohydrate researchers significantly in their studies. Glucan 1,4-alpha-maltotriohydrolase (GAM) from the organism *Microbulbifer thermotolerans* is a novel enzyme that theoretically breaks down the carbohydrate starch. Other maltotriohydrolases break the linkages in starch and remove consecutive maltotriose (M3) residues, a three-part sugar, from the chain ends. Traditional hydrolases such as alpha-amylase break down long-chain sugars into M3 and maltose, a two-part sugar. The use of this enzyme will allow for the generation of M3 sugar as the major product in a much more cost-efficient and easy manner. To obtain M3 sugar, the transformation and overexpression of the GAM protein in *Escherichia coli* were performed to generate large amounts of enzyme. This enzyme was then purified and utilized in starch activity assays to determine its capability of breaking down starch. To do this, a biosensor was used that determines the amount of small-chained sugars in solution. The biosensor was able to show that GAM is capable of breaking down starch into smaller units. This research will ultimately lead to the production of purified M3 which will be utilized by both biotechnology company Allos Bioscience, carbohydrate researchers, and potentially in the food industry.

Abstract ID: 2B-5

EXPLORATION OF ASYMMETRICAL COCHAPERONE BINDING AND REGULATION OF THE HSP90 ATPASE CYCLE

Casey Belway
The King's University

Hsp90 is a ubiquitous, highly conserved, 90 kiloDalton molecular chaperone that regulates the folding and maturation of substrate proteins identified as clients. Clients could include steroid hormone receptors, kinases, and transcription factors. Hsp90 functions by undergoing a dynamic, sequential ATPase cycle that is regulated by various cochaperones. The cycle of Hsp90 along with cochaperone and client binding is poorly understood and requires further research. The goal of this research was to specifically investigate the asymmetrical binding nature of cochaperones through Hsp90 Del-D-V:WT heterodimers. Through Michaelis-Menten analysis of heterodimer ATPase activity, we discovered that the Hsp90 Del-D-V:WT heterodimer was able to dramatically increase its ATPase rate through Aha1 binding. The current study also found that Sti1 had a decreased inhibitory effect on Hsp90 Del-D-V:WT when compared to wildtype. These findings indicate that Hsp90 Del-D-V:WT does bind cochaperones asymmetrically and highlights the key interaction that exists between cochaperone binding and the regulation of Hsp90 function.

Abstract ID: 2B-6

DEVELOPMENT AND CHARACTERIZATION OF MALTOTRIOSE DETECTING BIOSENSOR X

SarahAnn Walker
University of Lethbridge

Biosensors are created by using interactions that naturally occur between different molecules to detect and study particles and functions within a biological environment. Maltotriose (M3) is a sugar made up of three glucose molecules and is part starch metabolism. The ability of the protein MalX to bind M3 and be labeled with a fluorescent dye allows it to be used as a biosensor, which means it can be used to detect the level of maltotriose in a range of biological samples. There were a variety of single point mutations made to the MalX gene with the goal of providing a binding site for the fluorescent dye that will not affect the protein's function and abilities. The MalX gene was then inserted into a plasmid and transformed into *E .coli* cells through electrical shock. The protein was overexpressed, then purified through the use of a nickel affinity column followed by size exclusion chromatography. The purified MalX was labeled with a fluorescent dye, which provides the measurable signal allowing for the quantification of M3 in a sample. The sensor's stability and sensitivity were not affected by a range of incubation temperatures, pHs, and freeze/thaw cycles, and held up throughout the shelf life test where the sensor was kept at 4ºC for 6 months. Researchers will now be able to more effectively study maltotriose and the systems it is involved in over a range of biological environments with this biosensor.

Abstract ID: 2C-1

PHYTOCHEMICAL PLANT EXTRACTIONS USING SWITCHABLE-HYDROPHILICITY SOLVENTS

Gaganpreet Gill, Roland Lee and Tina Bott
Department of Physical Sciences, MacEwan University

Abstract ID: 2C-1

Essential oils extracted from plants contain phytochemicals that are useful for a number of applications, such as the food industry, cosmetics, and pharmaceuticals. Traditional methods of extracting these oils can involve using harmful solvents, which are typically removed using distillation and considered waste after each extraction process. Recently, an alternative class of solvents, called switchable-hydrophilicity solvents (SHSs), have been identified as an alternative to traditionally used solvents. SHSs can switch between being immiscible with water in its natural form, to miscible with water when mixed with dissolved carbon dioxide. Theoretically, SHSs can be used as a solvent to extract phytochemicals from plants and can be removed from the product of interest through switching rather than distillation. Additionally, a SHS could be readily reusable for sequential cycles of an extraction process. This presentation compares the use of *N,N*-dimethylcyclohexylamine (DMCHA) as a SHS in oil extractions against traditional methods (steam distillation and Soxhlet extraction) of extracting *Lavandula vera* (*L. vera*) essential oils. The chemical composition of essential oils and selectivity to compounds of interest were analyzed using gas chromatography-mass spectrometry. The findings of this project can be used for future contributions studying the sustainability of using SHSs as solvents in phytochemical plant extractions.

Abstract ID: 2C-2

THE SILICON NANOPARTICLE PUZZLE: PIECING TOGETHER THE ANOMALOUS HIGH-TEMPERATURE BEHAVIOUR OF HYDROGEN SILSESQUIOXANE.

Abbie Rubletz[1], Kevin M. O'Connor [1], and Jonathan G. C. Veinot[1]
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Silicon nanoparticles (SiNPs) have long been of interest due to their size dependent optical and electronic properties. A common method of producing SiNPs for these applications involves the thermally induced disproportionation of hydrogen silsesquioxane (HSQ; $HSiO_{3/2}$). This process yields nanocrystalline domains of elemental silicon within an SiO_2-like matrix, which can then be liberated for further functionalization upon exposure to HF. Previous work by the Veinot group has suggested that particle evolution occurs through a continuous, bottom-up mechanism with larger SiNPs attained by increasing the processing temperature and/or dwell time. However, recent attempts to produce big (d > 75 nm) nanoparticles have uncovered a high-temperature anomaly where this previously established explanation fails. Composites processed between 1500-1600℃ experience significant losses of both elemental silicon content and overall sample mass, but predicted trends re-emerge at 1700℃. These unusual results align with a number of phase changes within the composite, including the crystallization and eventual softening of the silica matrix, and melting of the silicon domains within it [SiO_2 crystallization point: ca. 1470 ℃, melting point: ca. 1710 ℃; Si melting point: ca. 1414 ℃]. Further, these occur alongside the consumption of any SiNPs through the silicon-assisted reduction of SiO_2 to SiO. Our ongoing research efforts involve further investigating and quantifying the nature of the interaction between the SiNPs and their matrix to explain the behavior of HSQ at high temperatures. This will provide the basis for a modified mechanism for SiNP evolution.

Abstract ID: 2C-3

A GREEN AND EFFICIENT ENE-CYCLIZATION OF CITRONELLAL INTO ISOPULEGOL IN WATER

Sarah Ritter, Liza Abraham
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Green chemistry involves the synthesis of organic molecules based on the 12 green chemistry principles. A green and efficient cyclization reaction was developed for the conversion of a naturally occurring aldehyde, citronellal, into isopulegol. Isopulegol is a precursor to menthol, which is widely utilized in pharmaceuticals and in the preparation of several biologically active compounds. The ene-cylclization of citronellal into isopulegol was successfully carried out at room temperature in water with Montmorillonite clay (MK-10) as the catalyst. The reaction was completed in 2 hours and the reaction progress monitored by ^{1}H NMR. Nine of the twelve green chemistry principles were employed in this novel cyclization procedure.

Abstract ID: 2C-4*

ANALYSIS OF ADVANCED GLYCATION END-PRODUCTS BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY COUPLED WITH ULTRAVIOLET DETECTION AND MASS SPECTROMETRY CHARACTERIZATION

Haley Wolgien, Makan Golizeh
Concordia University

Advanced glycation end-products, or AGEs, are a diverse group of complex, heterogeneous molecules formed by the Maillard reaction between a reducing sugar and an amine. They are produced endogenously in various cells and tissues in the body as well as in heat treatment of foods during non-enzymatic browning, also giving flavour and colour to the food. AGEs have been linked to aging and health complications including diabetes, renal disease, cataracts, and cardiovascular disease. They are difficult to analyze as they are hydrophilic, have limited ultraviolet absorbance, and have substantial diversity in their size and structure. Chemical derivatization adds a chromophore moiety and increases hydrophobicity, allowing for reverse-phase liquid chromatography (LC) separation coupled with UV or mass spectrometry (MS). In this study, reaction conditions were optimized for *in vitro* synthesis of AGEs in an aqueous solution of glucose, lysine, and a metal catalyst with conventional heating, and an analytical method developed for LC-UV detection of the resulting AGEs with derivatization by N-benzoyloxy succinimide (N-BOS). Seven AGE compounds were identified by HPLC with UV detection at 280 nm, and their identities were confirmed by LC-MS. The method developed was successful in separating and identifying the AGEs produced *in vitro* from glucose and lysine and is a promising first step for future studies into AGE formation from various sample compositions.

Abstract ID: 2C-5

BIOAUTOGRAPHY AS A METHOD FOR SCREENING FOR NOVEL ANTIMICROBIAL COMPOUNDS IN NOXIOUS WEEDS FROM ALBERTA

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The threat of rising antimicrobial resistance in society makes the discovery of novel antimicrobial compounds more important than ever before. Natural substances, such as bacteria and fungi, are a common source of antimicrobial drugs. Plants offer great potential in this regard, as their potential for containing novel compounds has been underexplored. Noxious weeds in Alberta are of particular interest because their phytochemical composition has not been fully studied, and they have been shown to disrupt soil microbe composition. One of the main hurdles of identifying phytochemicals that have antimicrobial activities is the slow and inefficient extraction and isolation of bioactive compounds. TLC-bioautography aims to simplify the identification of bioactive compounds by coupling the separation and testing of extracts together. This project's aim is to develop a reliable method of screening plant extracts for antimicrobial compounds using TLC-bioautography. The method was developed using plant extracts known to contain antimicrobial compounds to ensure activity was detectable. The separation of the extracts was optimized on TLC before directly overlying with Muller-Hinton Agar inoculated with bacteria. Lack of bacterial growth was observed around some spots on the TLC plate, indicating antimicrobial activity. Overall, our results show bioautography has the potential to quickly screen plant extracts for antimicrobial compounds. Having a method that can quickly screen for antimicrobials will help shorten the time it takes to research weeds of interest and isolate new and effective antimicrobials.

Abstract ID: 2D-1

DETECTING ANTIBIOFILM ACTIVITY IN PHYTOCHEMICAL EXTRACTS FROM LOCAL INVASIVE WEED SPECIES

McKayla Kirkpatrick, Jolie Hamel, Brittany Supina, Duncan Giebelhaus, Dr. Tina Bott, Dr. Kimberley Harcombe
MacEwan University

The development of antibiotic resistant pathogens is a serious global healthcare concern. Treatment for pathogens that form biofilms is particularly difficult because biofilm formation provides an extra physical barrier that enhances a pathogen's resistance to antibiotic treatment. New antimicrobial treatment options must be discovered to address this challenge. Invasive weeds are of increasing interest because of their potential to produce antimicrobial chemicals. Studies on the phytochemicals produced by local invasive weed species have been limited thus far, despite showing strong potential as a novel antibiofilm treatment due to their noxious and allelopathic nature. This project examined phytochemical extracts of invasive weeds from the local Edmonton, Alberta, environment and aimed to find evidence of extracts demonstrating antibiofilm activity. Previous students sequentially extracted samples with solvents of increasing polarity (hexane, ethyl acetate, and methanol). The solvent was removed by rotary evaporation, and the phytochemical mixtures were dissolved in DMSO to produce treatment extracts. Preliminary disk diffusion assays identified general antibacterial activity in these extracts, indicating potential for the extracts to also demonstrate activity specifically targeting biofilms. An antibiofilm assay was developed, in which biofilms of bacterial species were treated with phytochemical extracts. This assay identified phytochemical extracts of at least five weed species that had an effect on the growth of biofilm cultures. These extracts will be further studied to identify the specific phytochemicals causing the observed antibiofilm effects, and to assist in the development of new potential antimicrobial agents to treat antibiotic resistant pathogens.

Key Words
Antibiotic resistance; antibiofilm activity; invasive weeds; phytochemicals; biofilms; antibiofilm assay

Abstract ID: 2D-2

INVESTIGATION OF THE ANTIMICROBIAL ACTIVITY OF A NOVEL BACTERIOCIN, MITICIN

Daniah Alkassab, Daniel Major, Jeella Acedo
Mount Royal University

The development of antibiotic-resistant organisms, which makes treating previously curable infections difficult, has driven the search for antibiotic alternatives such as bacteriocins. Bacteriocins are ribosomally-synthesized antimicrobial peptides produced by bacteria. They are regarded as promising antibiotic alternatives due to their high potency, specificity, and low toxicity. In this study, a novel bacteriocin produced by *Streptococcus mitis*, miticin, was identified through genome mining. The production of miticin through protein expression resulted in a low yield. Therefore, we used a chemically synthesized peptide to establish the antimicrobial spectrum of miticin. Herein, we report the minimum inhibitory concentration of miticin against a suite of indicator organisms.

Abstract ID: 2D-3

ASSESSING EMBRYOTOXICITY AND ARYLHYDROCARBON RECEPTOR AGONIST ACTIVITY OF BENZOPHENONE (BP) AND BENZOPHENONE-3 (BP-3) ON ZEBRAFISH (*DANIO RERIO*) EMBRYOS

Emily Mertens[1], Steve Wiseman[1]
University of Lethbridge[1]

Benzophenones (BPs) are a group of organic UV filters that commonly enter the aquatic system where they can accumulate in abiotic and biotic matrices due to their photostability and lipophilicity. As such, there is growing concern over their toxicity. The aryl hydrocarbon receptor (AhR) plays a role in mediating toxicities associated with chemical exposure and a dysregulation of this receptor has been shown to elicit embryotoxicity. However, little is known about the relationship between toxicity of BPs and the AhR. The objective of this study was to determine toxicity of benzophenone (BP) and benzophenone-3 (BP-3) on zebrafish (*Danio rerio*) embryos, and if this is mediated through AhR activation. Zebrafish embryos were exposed triplicate to a DMSO control and four concentrations of BP (40, 8, 1.6, 0.32 mg/mL) and BP-3 (20, 4, 0.8, 0.16 mg/mL) via microinjections as this technique allows precise and consistent chemical deposition into embryos. Rearing and assessment for malformations and mortality of embryos occurred until 12 days post-fertilization (dpf). Transcript abundance of cytochrome P4501A (*cyp1a*) was quantified from injected embryos grown to 5 dpf to evaluate activation of the AhR in zebrafish, as this is a standard biomarker for AhR activation. Exposure to BP showed a significant decrease in survival in the highest concentration (20 mg/mL). In embryos exposed to BP-3 there was a concentration dependent response, where survival was shown to decrease at higher concentrations. Mechanistic results will also be presented. Future studies should look further into the sensitivity of the AhR to activation by BPs.

Abstract ID: 2D-4

DETERMINING THE BINDING AFFINITY OF A NOVEL THERAPEUTIC CANDIDATES AGAINST G-QUADRUPLEX REGION IN HBV CCCDNA

Sara Balderas Figueroa[1], Gerardo Balderas Figueroa[1], Simmone D'Souza[1,2], Maulik D Badmalia[1], Carla S Coffin[2,3], and Trushar R Patel[1,2,4]

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Globally, there are approximately 300 million cases of Hepatitis B virus (HBV) chronic infections. HBV is the leading cause of cirrhosis and hepatocellular carcinoma, which caused 820 thousand deaths in 2019. HBV entry into hepatocytes is mediated by sodium taurocholate co-transporting polypeptide (NTCP) receptor, and upon entry, the relaxed circular DNA (rcDNA) travels through the cytoplasm to the nucleus. Imported rcDNA undergoes a conformational change in the nucleus to form covalently closed circular DNA (cccDNA). Current therapies interfere with the viral cycle at or downstream from transcription, leaving cccDNA untouched. Consequently, patient relapse is common when treatment ceases. Previous studies have identified a G-quadruplex (G4) in the pre-core promoter of the HBV genome. During viral replication, an essential interaction between G4 and the Sp1 human protein occurs. Through phage display technology, we have found 11 novel molecules (S01 to S11) capable of targeting the G4 in the pre-core promoter region of HBV. The therapeutic candidates were expressed through bacterial recombination and purified using Ni-NTA and size exclusion chromatography (SEC). The therapeutic candidates' ability to target the G4 target sequence at a high affinity (KD) was determined through Microscale Thermophoresis (MST). Overall, these studies mark the initial groundwork for the development of therapeutic candidates able to disrupt the HBV viral cycle at the cccDNA stage.

Abstract ID: 2D-5

1,2,5,6-TETRABROMOCYCLOOCTANE (TBCO) IMPAIRS OOCYTE MATURATION IN JAPANESE MEDAKA, *IN VITRO* AND *IN VIVO*

Yamin Raza[1], Chloe Devoy[1], Steve Wiseman[1]
University of Lethbridge[1]

Brominated flame retardants (BFRs) are chemicals added to flammable products to increase their fire resistance. They can leach into aquatic environments where they have been shown to bioaccumulate, biomagnify, and induce toxicity in aquatic organisms. 1,2,5,6-tetrabromocyclooctane (TBCO) is an emerging BFR that's usage is predicted to soon increase. Although little is known regarding the toxic effects of TBCO, it has been shown to impair reproduction in Japanese Medaka (*Oryzias latipes*). This study explored inhibition of oocyte maturation as a potential mechanism by which TBCO impairs reproduction of Japanese medaka. Oocyte maturation assays were conducted using *in vitro* and *in vivo* exposure techniques. To assess effects of *in vitro* exposure, stage IX oocytes were excised from sexually mature female Japanese medaka and exposed to three concentrations of TBCO, followed by exposure to maturation-inducing hormone (MIH). To assess effects of TBCO on oocyte maturation following *in vivo* exposure, sexually mature fish were fed either a control, low (100 µg/g) or high (1000 µg/g) concentration of TBCO-spiked fish food for 21 days. Following the exposure, stage IX oocytes were excised to assess maturation in response to MIH. The *in vitro* exposure showed a significant decrease in maturation between the control and the medium concentration while the *in vivo* exposure showed a significant decrease in maturation at the 1000ug/g concentration compared to the control. Overall, TBCO has been shown to impair oocyte maturation in Japanese medaka both *in vitro* and *in vivo*. This finding helps explain the larger-scale impacts of TBCO on fish reproduction.

Abstract ID: 2D-6

ON GUARD®! ANTIMICROBIAL ACTIVITY OF A PROPRIETARY ESSENTIAL OIL BLEND AGAINST SKIN MICROBES

Christa Powers
Mount Royal University

There is ample research highlighting the antimicrobial activity of the essential oils (EOs) Cinnamon, Clove, Orange, Rosemary, and Eucalyptus found in dōTERRA©'s proprietary On Guard® blend. This suggests that this essential oil blend (EOB) may have its own antimicrobial properties; however, there currently is no published literature to confirm this. The purpose of this study was to investigate the antimicrobial activity of dōTERRA© On Guard® products against *Staphylococcus epidermidis*, *Bacillus subtilis, Staphylococcus aureus*, and *Pseudomonas aeruginosa*. To address this, the EOB was tested using a Kirby-Bauer disc diffusion assay in order to determine the antimicrobial activity of the EOB against skin microbes. Based on previously published research, it was proposed that the On Guard® EOB would have antimicrobial activity towards some or all of the selected microbes since its EO components have been shown to have antimicrobial properties. It was found that the EOB showed statistically significant antimicrobial activity against all four species of skin bacteria. Interestingly, the Cinnamon EO showed the highest antimicrobial activity, and even outperformed the Chloramphenicol positive control in some trials. The EOB also seemed to more selectively inhibit *P. aeruginosa* and *S.aureus* over *S. epidermidis*. These findings strongly suggest that the On Guard® EOB does have antimicrobial activity but further research is needed in order to confirm the statistical significance of the selectivity of the EOB, to solidify its potential as a treatment for bacterial skin conditions.

Session 2E|Statistics| May 6th 1:00 to 2:35 pm

Abstract ID: 2E-1

THE EFFECTS OF BIOLOGICAL SEX, LEARNING STYLE AND TEACHING METHOD ON POST-SECONDARY STUDENTS' PERFORMANCE IN BIOLOGY LABORATORIES

Bethany Snaterse
The King's University

The purpose of this study was to determine if women are more likely than men to exhibit a certain learning style; if students perform significantly better when teaching methods align with their preferred learning style; and, if a specific teaching method is most conducive to learning in a laboratory setting, regardless of sex or learning style. This was tested by comparing the difference between pre- and post-laboratory test scores for female and male students with various learning styles in either a student-led or teacher-led laboratory. General descriptive statistics were performed during analysis, including two-sample T-tests for continuous data, Fisher's Exact Test for categorical data, and Pearson's product-moment correlation test between categorical and continuous data. Results showed a significant difference between pre- and post-laboratory test scores for all participants, but no significant difference between scores of female and male students, students of different learning styles, students who experienced a different type of laboratory, or students whose lab experience aligned with their preferred learning style. These results contradict much of the current literature pertaining to women in STEM, and learning styles theory. Further study should examine the difference between student-led and teacher-led laboratories using qualitative methods, such as student attitude and enjoyment to better understand which type of laboratory is most effective for teaching biology to post-secondary students.

Abstract ID: 2E-2

A LESSON FOR THE FUTURE: WILL YOU LET ME VIOLATE YOUR PRIVACY TO SAVE YOUR LIFE?

Brian Atuh, Khosro Salmani
Mount Royal University

COVID-19 was an unprecedented pandemic that changed the lives of everyone. To handle the rapid spread of the virus, governments implemented Contact Tracing Applications (CTAs), but the response by the public was different in each country. While some countries forcibly downloaded the application to their citizens' smartphones, others made it optional, and this revealed contrasting patterns to the spread of COVID-19. This study aims to disclose the public's perception of these varying patterns and, if known of the results of other nations, would sacrifice their freedoms to prevent the spread of a future pandemic. First, a survey was conducted, gathering the responses from 154 participants across Canada. Next, we questioned the participants regarding their following of the COVID-19 pandemic, knowledge, and opinion of contact tracing applications before presenting our findings regarding how other countries implemented CTAs. After presenting our results, we then asked the participants their views of CTAs again. The arrangement of the preceding questions, the findings, and succeeding questions to identify whether Canadian's views on CTAs would change have the proper evidence been presented. Among all of our findings, there is a clear difference between before and after the findings regarding whether CTAs should be mandatory, with 34% of participants agreeing before and 56% afterward. This hints that all the public needed was information to decide where or not to participate. Although the finding could only be gathered following a global pandemic, it exposes the value of transparency and communication when persuading the public to act collectively.

Abstract ID: 2E-3

SCIENCE LITERACY AND GENERAL EDUCATION: QUANTITATIVE ASSESSMENT OF UNDERGRADUATE STUDENT SCIENCE LITERACY.

Nahuel Paladino[1], Basira Yaqoub[1], Mandy Sobhanzadeh[2], Nick Strzalkowski[1,2]
[1]Faculty of Science and Technology, Mount Royal University, Alberta, Canada
[2]Faculty of Teaching and Learning, Mount Royal University, Alberta, Canada

Background: Civic and personal decisions increasingly rely on scientific knowledge. Enhancing science literacy through undergraduate education offers benefits to individuals and communities. Mount Royal University (MRU) promotes student science literacy through the General Education program that aims to "*develop capacities for scientific reasoning*" in all undergraduates. This project is the quantitative arm of a mixed-methods study investigating undergraduate student science knowledge, beliefs, and engagement.

Methods: To date, 191 participants have completed a custom online science literacy questionnaire that assessed: foundational knowledge, attitudes and engagement, and pseudoscientific beliefs. MRU undergraduates were recruited from 1st and 4th year courses across all programs.

Results: Foundational science knowledge was found to be significantly higher in men vs. women (P=0.0089), and in science vs. non-science majors (P=0.0063) while no differences were found between 1st and 4th year participants (P=0.3937). In addition, women answered "unsure" more often than men (P=0.0230), and non-science answered "unsure" more often than science majors (P=0.0014). When asked to assess their own science literacy, men, science majors, and 4th year participants were significantly higher than women (P=0.0378), non-science majors (P<0.0001), and 1st year participants (P=0.0001) respectively.

Conclusions: Preliminary findings indicate that there were gender and program differences in undergraduate students' foundational science knowledge. 1st and 4th year participants' foundational knowledge was not different despite 4th year students self-assessing their science literacy higher. Future work aims to better understand and address these group differences.

Abstract ID: 2E-4

IMPACT OF REMOTE-LEARNING ON WORKING STUDENTS IN COMPUTER SCIENCE

Joel Conley, Chidera Uzoka, Khosro Salmani
Mount Royal University

One of the many drastic effects of the COVID-19 pandemic in early 2020 was a sudden shift to remote learning for post-secondary students. As of early 2022, remote learning is an ongoing policy for many educational institutions, the impact of which on students is yet to be understood. This study aims to build a foundation for that understanding, with a particular focus on addressing the effects on students who were working concurrent with their studies through the pandemic. A survey was conducted, gathering 181 responses from undergraduate computing students. The survey queries the students' experience with work-school balance during the pandemic, their feelings about online classes and performance in them, the perceived positive and negative aspects about learning online, and whether they would opt in to online classes in the future in the absence of any pandemics. The results show a clear perception of increased flexibility (88%) coupled with an increase in the students' ability to manage their time (61%). Where working students are concerned, the survey found that 67% either had a reduction in working hours. Given that 72% of the respondents' report that online classes are more convenient than in-person classes while only 22% report a negative impact on their performance, this study concludes that online learning opportunities may correlate with an easing of stress on post-secondary students without significantly impacting academic performance.

Abstract ID: 2E-5*

BEHAVIORAL ANALYSIS OF A RAT REACHING TASK USING MACHINE LEARNING

Joletta Vanrhijn
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Sleep is indicated to play an important role in memory consolidation. Prior studies indicate that neural activity induced during a behavioral task is replayed during sleep. Targeted Memory Reactivation (TMR), a method where a sensory stimulus is presented both during task completion and during sleep, seems to aid in the process of memory consolidation. Despite some success stories, the field also has negative results and the effectiveness of TMR remains controversial. In many studies, the behavioral analysis of TMR's effect was done using manual scoring, either through a simple success/fail system or an analysis of individual movement segments. However, behavioral data is often more nuanced, and therefore incomplete data analysis may be causing inconsistency within the field. Using a more consistent and reproducible machine learning approach may prove to be successful if video quality is sufficient. DeepLabCut, an open-source machine learning software can track lab animals as they complete a behavioral task. Using its output, motion trajectories can be compared and analyzed using differences in dispersion. Failed reaches are proposed to create a more dispersed motion pathway, while an increasingly skilled rat is thought to create a more consistent one. This could aid in distinguishing a difference in skill acquirements between animals exposed to TMR, and those who were not. Initial findings using DeepLabCut indicate that following the trajectory of the paw alone is not sufficient to determine behavioral differences between control and experimental models. An analysis using high-quality video data with digit tracking is likely necessary to determine differences between the models.

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