Program & Abstracts



5th Annual Research Day

April 4th, 2018 Lincoln Park Room



Faculty of Science and Technology

Message from the Research Day Committee,

We are pleased to present this compilation of the abstracts of students' research projects, presented as posters at the fifth annual Faculty of Science & Technology Research Day at Mount Royal University. The research presented here encompasses both independent research projects and research in the classroom. In this volume, you will find 87 abstracts, authored by MRU students, covering with a variety of disciplines including



Biology, Chemistry, Geology, Geography, Environmental Sciences, Mathematics, Physics, and Computer Science. This compilation is a testimony to our students' hard work, and their professors' diligent guidance. Congratulations to both the students and professors on these accomplishments!

One notable feature this year is that we are organizing the keynote public lecture on the same day as the Research Day – April 4. This has facilitated April 4, 2018 being designated completely for the Faculty of Science & Technology Research Day during the MRU Research & Scholarship Days. The title of the keynote lecture is "SNOWBALL EARTH: Did global glaciation change the course of biological evolution?" by Dr. Paul Hoffman, Professor Emeritus, Harvard University. The abstract of the presentation is also included in this collection.

We also would like to thank our sponsors Fisher Scientific, VWR International, Pearson Canada, Dana Hospitality and MRU Institute for Environmental Sustainability for their support. We also would like to acknowledge the support from the Office of the Provost and Vice-President Academic for supporting and organizing the keynote lecture. This volume would not be complete without thanking our Dean, Jonathan Withey, for his unwavering support and ideas, Dean's Office staff Carla Slavik and Karen Johnstone for helping in many different ways, and Chair of Earth & Environmental Sciences, Brian Sevick, for supporting poster printing. Special thanks are due to Jenn Sheehan and other staff of Marketing and Communications for their valuable contribution in designing and promoting publicity material for the event.

Last but not least, special thanks go out to our dedicated judges and volunteers without whom the award decisions would not be possible. We sincerely hope that this volume will be a source of inspiration for future students in our Faculty and beyond, and that it might propel them to research, discover, and explore the world of science and technology.

Sincerely,

Faculty of Science & Technology Research Day Committee

M. Qasim Syed (Chair) Katherine Boggs Trevor Day Shoba Ittyipe Brett McCollum Jonathan Mee Raghed Mirza Gwen O'Sullivan Raphael Slawinski Peter Zizler Mariya Svishchuk Carla Slavik (Administrative Support)













Invited Speaker

Snowball Earth: Did global glaciation change the course of biological evolution?

Presented by Paul Hoffman, PhD April 4, 2018 Lunch: 11:45 a.m. – Jenkins Theatre Lobby Presentation: 12:30 p.m. - Jenkins Theatre

Paul Hoffman, one of the greatest and most charismatic scientific story-tellers of our time, is the 2018 keynote speaker for the Faculty of Science and Technology Research Days. Paul is world renown for his "United Plates of America" concept of how the North American continent originated, and for his outspoken support for "Snowball Earth," the theory that glaciers extended from pole to pole over land and sea for millions of years, shortly before the evolutionary explosion of multicellular animal life. He predicts that a legacy of Snowball Earth exists in the genomes of living organisms.

Paul's theorizing is grounded in over fifty years of geological field work in northern Canada and southern Africa, driven by his curiosity about the world beneath our feet. He found that the scope of geological history is such that even the field geologist must learn to think at different times like a chemist, a physicist, an astronomer and a biologist. He was originally drawn to geology because he thought it meant going to wild places, making amazing discoveries, and giving famous lectures. He was not disappointed.

Paul's Credentials:

Officer of the Order of Canada (appointed 2012) Emeritus Sturgis Hooper Professor of Geology, Harvard University Fellow Royal Society of Canada Logan Medal (highest honour of the Geological Association of Canada; 1992) Penrose Medal (highest honour of the Geological Society of America; 2011) Wollaston Medal (highest honour of the Geological Society of London; 2009) Gold Medal Royal Canadian Geographical Society (2016)



Poster Sessions – Lincoln Park Room

Morning Session (10:00 AM - 12:00 PM)		
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1000	Characterization of Astrocytes in Mouse CA1 Hippocampus	Brian Lozinski; Biology
1002	Acute hyperglycemia decreases neurovascular coupling magnitude in healthy females and males	Zahrah Rampuri, Trevor Day, Craig Steinback, Margie Davenport, Tysen Joki, Jeena Lorida and Elaine Soriano; Biology
1004	mGluR5 is Distributed in Clusters in Murine Astrocytes	Brian Marriott; Biology
1006	That's the mCherry on top of Mutating Fluorescence Proteins	Andrew Michael; Biology
1008	Characterization of the mCherry fluorescent protein	Brittney Steer; Biology
1010	The Distribution of Resilin in the Wings of Bumble Bees (Bombus spp.)	Vijata Sharma and Robin Owen; Biology
1012	The Effects of Lead Exposure on Neurodevelopment	Kaman Sandhu; Biology
1014	Quantification of Tissue Specific Expression of ABC type B transporters in Eschscholzia californica	Jonathan Roveredo, Perpetua Uzuegbu and David Bird; Biology
Chemistry		
1100	The Effect of Crowding Agents on the Uncompetative Inhibition of Alkaline Phosphatase	Michael Cordara; Chemistry and Physics
1101	Improving confidence and performance at communicating in chemistry	Andrew Roberts, Michael Wentzel, Isaiah Ripley, Layne Morsch, Benita Ekwonwa, Brett McCollum and Vinita Kumar; Chemistry and Physics
1102	Sunscreen Dendrimers	Yelizabeta Dmitriev, Benny Rana and Ashan Ayub; Chemistry and Physics

1103	Air Quality, A wicked problem affecting the world	Erance Cleo Villanuova and
1105	All Quality: A wicked problem allecting the world	Geraldhine Lopez; Biology
Environmen	tal Science & Sustainability	1
1300	Effects of marine traffic on bowhead whale distribution and abundance	Natalie Hoa; Biology
1302	Hydrophobic Soil - Root system influence upon disintegration of hydrophobic layer, analyzed through Infiltrometer testing	Jordan Chu, Duncan Shipley, Caitlin Sexton, Megan Kraus, Mitchell Barnes and Greta Vela; Earth and Environmental Sciences
1304	Comparison of a crystallization inhibitor and gypsum flushing for treatment and remediation of brine affected soils	Sydney Davenport, Tim Kruchkowski, Simone Rodger, Alex Coombs and Darla Frank; Earth and Environmental Sciences
Geography	& Spatial Analysis	
1400	Google Earth Virtual Field Trip for the Monashee Basement Core Complex, B.C.	Joseph Temones; Earth and Environmental Sciences
Mathematic	s & Statistics	1
1600	Mathematical Modelling of a Measles Outbreak in Pre- vaccine England and Wales	Michael Wendlandt, Loren Cobb and Murdoch McKinnon; Mathematics and Computing
Geology		
1500	Differences in the Family	Jacob Lucyshyn; Earth and Environmental Sciences
1502	History and Movement of the Rocky Mountain Trench	Sarah Te Linde; Earth and Environmental Sciences
1504	Tectono-metamorphic history of blueschist metabasite in Corsican ophiolite sequence	Elyse Marzolf; Earth and Environmental Sciences
1506	Creosote Contamination and Movement in Calgary, Alberta	Joseph Cloutier; Earth and Environmental Sciences
1508	Archean veins of life: first signs of life attributed to heat and minerals at hydrothermal vents 3.6 billion years ago	Sheri May, Jenni Scott, Kory Tardiff, Shamus Harder, Jordan Shackman and Haley Fiedler; Earth and Environmental Sciences
1510	It was the abrupt decline in atmospheric CO2 ~34 Ma that led to Antarctic glaciers and the beginning of widespread Cenozoic glaciation.	Sasha Lewis, Trevor MacDonald, Rolando Lanto, Richard Tucker and Taryn Hinton; Earth and Environmental Sciences

1512	Structural Controls on Epithermal Springs in Southeastern British Columbia	Connor Fornwald; Earth and Environmental Sciences
1514	Lower Carboniferous Brachiopods of the Mississippian Banff Formation	Justice Kyeremeh and Muhammad Azlan; Earth and Environmental Sciences
1516	Fossil Abundance and Diversity at the Trilobite Beds of Mount Stephen	Dylan Desjardins and Paul A. Johnston; Earth and Environmental Sciences
1518	Mystery fossils of the Lower Cambrian Gog Group	Natasha Campbell and Conor Newton; Earth and Environmental Sciences
1520	Middle Cambrian calcium-rich oceans: A make it or break it time for life on Earth	Tara Berglund, Jenni Scott, Shaylin Sampson, Aryan Tyagi, Hector Munoz and Haley Leavitt; Earth and Environmental Sciences
1522	Sustainable Reclamation: A toxicological comparison of bitumen-stained sandstones to tailings of an end pit lake	Ramon Vamenta; Earth and Environmental Sciences
1524	Limpets Take a Bite Out of the Mosasaur Hypothesis	Wesley Barr and Paul Johnston; Earth and Environmental Sciences
1526	Californian Franciscan Complex Serpentanized Mélange Serpentine-Talc Nodule	Devin Recsky; Earth and Environmental Sciences
1528	Investigating the Nizi Deposit of Northern British Columbia: a mineralogical examination of a prospective economic molybdenum, copper, and gold deposit	Darby Desrosiers; Earth and Environmental Sciences
1530	The Phosphoria Formation, Possible Source Rock for Fracture Fill Hydrocarbons of the Green River Formation	Ngoc Nguyen and Jennifer Scott; Earth and Environmental Sciences
1532	Potential Source Formations of Sulfate for the Paskapoo Aquifer of Alberta	Hugh Alvarez; Earth and Environmental Sciences
1534	Coastal plain sequence stratigraphy of the "Cathedral mud" horizon of the upper Dinosaur Park Formation, Dinosaur Provincial Park, Alberta	Adam MacInnis and Taia Wyenebrg-Henzler; Earth and Environmental Sciences
1536	Olistostrome as Related to Blueschist and Greenstone in the Franciscan Complex	Ania Moisi; Earth and Environmental Sciences
1538	The Franciscan Complex Greenschist	Johnathan Hagerman; Earth and Environmental Sciences
1540	Calcsilicate sheath fold metamorphism in Corsica, France	Allyssa Preece; Earth and Environmental Sciences
1542	No Title Provided	Nkenjika Ngini; Earth and Environmental Sciences
1544	Subduction Zone Serpentinite of Western California	Riley Medd; Earth and Environmental Sciences

1546	How did high levels of carbon dioxide change Cretaceous climate and life during the 10-million-year period from the Cenomanian—Turonian at ~100 million years ago?	Brayden Thorogood, Andrew Boudjaklian, Braden Armstrong, Thomas Wooff and Naomi Attrill; Earth and Environmental
1548	Petrogenesis and tectonic seting of the Paleoproterozoic Kangilleq Formation of west Greenland and its correlation to the Bravo Lake Formation of Nunavut,	Sciences Candace Toner; Earth and Environmental Sciences
Wildlife Beh	Canada aviour, Conservation & Ecology	
1900	There's something fishy about the seafood market	Catharine Tucker, Mitchell Cornell, Breanne Marois, Curtis Klemmensen, Carolyn Ly and Alvee Straub: Biology
1902	Stress behaviours associated with weaning quarter horse foals	Candace Ferguson; Biology
Afternoon Session (2:00 PM - 4:00 PM)		
Poster	Title	Author(s); Affiliation
Cell & Organ	nismal Biology	
1001	Effect of Q163E mutation on mCherry fluorescence	Brian Lozinski; Biology
1003	Tracking Cerebral Blood Flow Regulation during Incremental Ascent to Altitude: Effect of Superimposed Hypoxia and Hypocapnia	Hailey Lafave, Shaelynn Zouboules, Marina James, Graeme Purdy, Jordan Rees, Craig Steinback, Tom Brutseart, Cassandra Nysten, Heidi Nysten, Mingma Sherpa, Trevor Day; Biology
1005	Renal Acid-Base Compensation Demonstrates Plasticity During Incremental Ascent to High Altitude	Shaelynn Zouboules, Trevor A. Day, Mingma T. Sherpa, Craig D. Steinback, Ken D. O'Halloran, Cassandra E. Nysten, Tom D. Brutsaert and Heidi Nysten; Biology
1007	The effects of vitamin A, C and D on the expression of α B-crystallin in the lens of an embryonic chick	Jeena Lorida; Biology
1009	Elevated blood CO ₂ increases anterior cerebral blood flow responses to the cold pressor test	Scott Thrall, Leah Mann and Brittney Herrington and Trevor Day; Biology

1011	Glucose tolerance is unchanged during acute normobaric hypoxia	Jason Chan, Trevor Day, Craig Steinback, Margie Davenport, Mackenzie Kozak, Garrick Chan, Alexander Rimke and Alexandra Chiew; Biology
1013	Calbindin Protein Expression in the Embryonic Chick Cerebellum in Response to Vitamins A and D	Krystal Nicor; Biology
1015	Blue-shifting mCherry Excitation and Emission Maximas using Site Directed Mutagenesis	Lauren Gordon, Michael Cordara, Clifford Pasion and Mataya Van Heyst; Biology
Environm	ent & Sustainability	
1301	Adaptation of a Microbial Fuel Cell to a Model Wetland System	Taylor Vodopija, Anne Neumann, Justin Cyr, Curtis Pridham and Allie Schumann; Earth and Environmental Sciences
1303	The Effect of Microplastic on Soil Infiltration Rate	Kevin Cho, Matthew Mikkelson, Kevin Hayes, Clifford Pybus and Jesse Elcombe; Earth and Environmental Sciences
1305	Soil Saturation by Capillary Action: An Alternative to Saturated Paste and Soil-Water Suspension	Charde Clark, Anya Batycky, Eduard Seleznov, Jeremy Duckworth and Ty Malowany; Earth and Environmental Sciences
1306	Determining the effects of a simple carbon source versus a complex carbon source on aggregate formation, microbial activity, and the accumulation of organic matter content	Tina McLean, Kayla Kanwischer, Benton Dalgleish, Derek DiMarzo, Michelle Harris and Mercy Maina; Earth and Environmental Sciences
1307	The Effect of Plant Uptake of Ski Wax on the Growth Rate of Avena Sativa and Medicago Sativa	James Walker; Earth and Environmental Sciences
Scholarsh	ip of Teaching and Learning & Outreach	
1800	Emergence of Different Perspectives of Success in Collaborative Learning	Sarina Falcione and Ellie Campbell; Chemistry and Physics
Physics		
1700	Implementation of Quantum Logic Gates Using Linear Optics	Adam Gutsche; Chemistry and Physics
1701	Understanding the human cardiovascular system from a biophysical perspective using a mechanical simulator	Jan Elaine Soriano; Chemistry and Physics

Geology		
1501	Metamorphism of Ophiolites in the Ocean Continent Transition of Northern Corsica	Joseph Lillis; Earth and Environmental Sciences
1503	Losing its Cool: The Melting of Canada's Infrastructure	Abbey Rippenhagen; Earth and Environmental Sciences
1505	Serpentine Melange in California Franciscan Complex	Douglas Toner; Earth and Environmental Sciences
1507	A California Blueschist Nodule in a Serpentinized Mélange	Kiel Del Mundo; Earth and Environmental Sciences
1509	Blueschist Metamorphism in the Franciscan Complex	Cristian Otalora; Earth and Environmental Sciences
1511	Complex Metamorphic Conditions of Northern Corsica	Kate Nicas; Earth and Environmental Sciences
1513	Regional Fluid Flow Impacts on Magnesian Ore Deposits from Mount Brussilof, British Columbia: A Comprehensive 3D Model and Petrographic Analysis	Daniella Pietrocarlo; Earth and Environmental Sciences
1515	Non-Functional Morphology—Adaptive Significance of Bivalve Shell Features Reconsidered	Samantha Warren and Kelly Stasiuk; Earth and Environmental Sciences
1517	Sedimentary Mélanges and Low Grade Metamorphism on Coastal California	Alexandra Patterson; Earth and Environmental Sciences
1519	Eocene Ancestors of Botflies (Oestridae)	Jeffrey Yee and Samantha Mathews; Earth and Environmental Sciences
1521	Form and function of prosopon in Devonian Trilobites from Draa Valley, Morocco	Daniel Leboeuf, Taylor Brown and Megan Goulet; Earth and Environmental Sciences
1523	Mississippian Brachiopods and Peculiar Tube Structures of the Lead Cove Region, Newfoundland	Adam Gutsche; Earth and Environmental Sciences
1525	Evidence for an ancient subduction zone in western California	Mathieu Boudreau; Earth and Environmental Sciences
1527	Crawfordsville Crinoids: Identification and Interpretation	James Climie and Victoria Tenor; Earth and Environmental Sciences
1529	Ophiolite Metamorphism of Alpine Corsica	Shelby Austin-Fafard; Earth and Environmental Sciences
1531	Folded Eclogite and Blueschist of Alpine Corsica	Adam Gutsche; Earth and Environmental Sciences
1533	Significance of serpentinite in Coast Range ophiolite, California	Erik Guma; Earth and Environmental Sciences

1535	The Search for Coalbed Methane in Southwest Alberta	Virginia Gold; Earth and Environmental Sciences
1537	Potential for Diamonds in the Kootenay Arc-Southeastern British Columbia: Petrographic Analysis of Lamproitic Rocks from	Kathryn Targett; Earth and Environmental Sciences
1539	Geochemistry and petrography of gold-quartz-tourmaline veins in Cenozoic rocks of the Kootenay Arc, Bunker Hill mine site, British Columbia	Leela Witvoet and Y.M. DeWolfe; Earth and Environmental Sciences
1541	Cretaceous Ammonites of Alberta	Taylor Wasuita and Dallan Beaudin; Earth and Environmental Sciences
1543	From the Mantle to the Mountains	Evan Matthews; Earth and Environmental Sciences
1545	The History of The Franciscan Complex and the Importance of Mélanges	Alexander Burn; Earth and Environmental Sciences
1547	Serpentines is Corsica	Robert Blyth; Earth and Environmental Sciences
1549	Trace Fossils of the Gog Group—Smoke from the Cambrian Explosion	Ryley Penner and Devon Brown; Earth and Environmental Sciences
Wildlife E	Behaviour, Conservation & Ecology	
1901	Attraction of Black-billed Magpies to bright versus dull objects	Toni Vandenbrink; Biology
1903	To cross or not to cross? Pedestrian risk taking behaviour not influenced by weather conditions	Carolyn Ly; Biology

Abstracts

Cell & Organismal Biology

Poster #1000, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Characterization of Astrocytes in Mouse CA1 Hippocampus

Authors: Brian Lozinski

<u>Abstract</u>

Astrocytes are non-neuronal cells of the central nervous system that have a complex branching, protoplasmic morphology in grey matter regions of the brain, and contact the vasculature and synapses. Astrocytes are fundamental in regulating neuron activity and local blood flow in response to synaptic environments. The distribution of the branched processes of protoplasmic astrocytes have not been characterized using methods that accurately portray their native structures. Here we aimed to characterize the distribution of protoplasmic astrocyte processes in the CA1 region of the hippocampus. The CA1 region was chosen because the neuronal pathways have been studied in detail and can provide a good baseline to compare to other regions, and to diseased brains. Astrocytes in mice were labeled with lipophilic dye using ballistic delivery of micron sized, dye coated tungsten. Using confocal microscopy, we imaged labeled cells and produced 3-dimensional stacks of labeled astrocytes. Characterization of the distribution of processes was done using IMARIS(tm) filament tracer and Sholl analysis. Our preliminary results show that both the size of the astrocytes and distribution of processes from the cell body are heterogeneous. Despite the differences in the distance of processes from the soma there is a uniform decline in processes toward the periphery in all astrocytes. Understanding the basal morphological complexity of astrocytes provides (a) means to understand how their organization influences their function in different areas of the brain (b) will provide us with fundamental morphological information necessary to better investigate neurological disorders associated with astrocytes (eg. MS, Alzheimer's, stroke).

Keywords: Neurobiology, Cell biology, astrocytes, confocal microscopy, morphology

Supervisor: Adrienne Benediktsson

Poster #1001, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Effect of Q163E mutation on mCherry fluorescence

Authors: Brian Lozinski

<u>Abstract</u>

Fluorescent proteins, such as mCherry, are widely used in microscopy to study the internal functions and structures in living cells. Fluorescence is the excitation of a fluorophore by a specific wavelength of light which results in the release of a longer wavelength of light. Changing the amino acid glutamine(Q) at residue 163 to glutamate(E) of the fluorescent protein mCherry has been found to cause both red and blue shifts when paired with other changes. Shen et al. (2017, PLoS One 12:1-12) found that an altered

form of mCherry containing a number of changes, including Q163E, resulted in the fluorescence shifting toward yellow fluorescence. The purpose of this project is to determine the effect that the glutamine to glutamate mutation at the 163 residue has on the excitation and emission of mCherry. I used site-directed mutagenesis to mutate the native mCherry gene to create the Q163E mutation. This gene (mCherry Q163E) was transformed into E. coli and induced to express the mutant protein. Protein extractions were collected and measured on a fluorescence spectrophotometer to collect excitation and emission spectra. Because of the findings of Shen et al. (2017, PLoS One 12:1-12) I expect that the mutation should cause a blue shift in the excitation peak of mCherry. Understanding the effects of individual mutations on the fluorescence of mCherry provides insight into how the residue interactions with the fluorophore impacts fluorescence. It can also provide fundamental information for developing new fluorescent proteins for live-cell imaging.

Keywords: mCherry, Fluorescence, glutamine, glutamate, mutation, mutant, protein

Supervisor: David Bird

Poster #1002, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Acute hyperglycemia decreases neurovascular coupling magnitude in healthy females and males

Authors: Zahrah Rampuri, Trevor Day, Craig Steinback, Margie Davenport, Tysen Joki, Jeena Lorida and Elaine Soriano

<u>Abstract</u>

Neurovascular coupling (NVC) is the link between neural activity and the corresponding changes to regional cerebral blood flow. Chronic hyperglycemia associated with diabetes has deleterious effects on vascular function. However, the potential effects of acute hyperglycemia on NVC in healthy humans is unknown. We aimed to characterize the effects of acute hyperglycemia on NVC response magnitude in females and males, and hypothesized that acute hyperglycemia would reduce NVC response magnitude. 40 healthy participants (21.6 ± 1.7 yrs; BMI 24.1 ±4.1 kg/m²; 20 females) were instrumented with electrocardiogram (ECG) to measure heart rate (HR), Finometer to measure mean arterial pressure (MAP), transcranial Doppler ultrasound (TCD) for measurement of posterior cerebral artery velocity (PCAv). Blood glucose was tested using a glucometer and capillary draw via sterile lancet. NVC responses were elicited using a standardized strobe light visual stimulus (VS; 6Hz, 360rpm; 5x30sec on/60sec off) before (fasted) and 30-min after an acute hyperglycemic load (75g glucose, 300ml; 4.8 ± 0.4 vs. 7.5 ± 1.2 mg/dl; P<0.0001). NVC magnitude was quantified as the difference (delta) and percent (%)-change between the mean baseline (2-min average) and the mean of five responses over the 30-sec VS. Acute hyperglycemia reduced delta NVC responses (4.8±3.9 vs. 3.3±3.4 cm/s; P=0.004) and %-change NVC responses (12.5±9.6 vs. 8.1±7.9%; P=0.002). Neither delta nor %-change NVC responses were different between women and men while fasted (P=0.98; P=0.74), nor when hyperglycemic (P=0.42; P=0.34). Our data suggest that acute hyperglycemia decreases NVC response magnitude in healthy adults equally in females and males.

Keywords: Neurovascular coupling; hyperglycemia; men; women

Supervisor: Trevor Day

Poster #1003, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Tracking Cerebral Blood Flow Regulation during Incremental Ascent to Altitude: Effect of Superimposed Hypoxia and Hypocapnia

Authors: Hailey Lafave, Shaelynn Zouboules, Marina James, Graeme Purdy, Jordan Rees, Craig Steinback, Tom Brutseart, Cassandra Nysten, Heidi Nysten, Mingma Sherpa, Trevor Day

Abstract

High altitude exposure imposes a unique cerebrovascular challenge due to two opposing blood gas stimuli. Specifically, hypoxia causes cerebral vasodilation, increasing cerebral blood flow (CBF), whereas respiratory-induced hypocapnia causes cerebral vasoconstriction, decreasing CBF. The conflicting nature of these two superimposed chemostimuli presents a challenge in tracking CBF responsiveness. In 16 lowlanders during incremental ascent, we aimed to (a) characterize the relationship between arterial blood gas stimuli with regional and global CBF and (b) develop a novel index to track changes in CBF in relation to conflicting chemostimuli. During ascent to 4370m over seven days in the Nepal Himalaya, participants underwent serial resting measures at 1045m, 3440m (day 3) and 4370m (day 7). These measures included: arterial blood draws [(Pa)CO2, (Pa)O2, arterial O2 (SaO2)], unilateral anterior, unilateral posterior and global CBF (Duplex ultrasound; internal carotid artery [ICA] and vertebral artery [VA], global CBF [{ICA+VA}x2], respectively). We developed a novel stimulus index (SI), taking into account both chemostimuli (PaCO₂/SaO₂). Subsequently, both regional and global cerebral CBF were indexed against the SI to assess steady-state cerebrovascular responsiveness (SS-CVR). PaCO₂, PaO₂ and SaO₂ all decreased with ascent to altitude (all P<0.001). Anterior (ICA) and global CBF did not increase significantly with ascent (P=0.15 and P=0.09, respectively). However, posterior (VA) CBF was significantly increased at 4370m (P=0.03). SS-CVR for both regional and global CBF was significantly increased at 4370m (P ≤ 0.03), which highlights the importance of the breaking effect of hypocapnia on CBF regulation at altitude.

Keywords: Incremental Ascent; Hypoxia, Hypocapnia; Cerebral Blood Flow

Supervisor: Trevor Day

Poster #1004, Presentation Time: 10:00 am - 12:00 pm

Abstract title: mGluR5 is Distributed in Clusters in Murine Astrocytes

Authors: Brian Marriott

<u>Abstract</u>

Astrocytes, one of the main types of non-neuronal cells in the brain, actively participate in neuronal signalling through a receptor called mGluR5 (metabotropic glutamate receptor 5). The complex shape of astrocytes, with many fine, branching process that project from the cell body, allows them to interact with hundreds to thousands of neurons. However, the localization and distribution of mGluR5 throughout astrocytes has not yet been defined, and it is not known whether mGluR5 is distributed in random, evenly-spaced, or clustered patterns. We hypothesized that, similar to the patterns observed in neurons, mGluR5 would be clustered in microdomains around adjacent synapses. We aimed to quantify the distribution pattern of mGluR5 throughout astrocytes using immunohistochemistry, DiOlistics, and 3d confocal microscopy to image astrocytes within adult mouse hippocampal brain slices. Images were

analyzed using ImarisTM, and manipulated files were imported into FIJI. We analyzed the spatial distribution of mGluR5 puncta within 3D images of three astrocytes, and computed statistics to evaluate whether the distribution was random, evenly-spaced, or clustered in each astrocyte. The spatial distribution of mGluR5 was significantly clustered in each case, indicating that mGluR5 is not randomly dispersed throughout the cells. This provides an important point of comparison for future research, as protein distribution in astrocytes remains less studied than in neurons.

Keywords: Neuroscience; Astrocytes; Microscopy; mGluR5

Supervisor: Adrienne Benediktsson

Poster #1005, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Renal Acid-Base Compensation Demonstrates Plasticity During Incremental Ascent to High Altitude

Authors: Shaelynn Zouboules, Trevor A. Day, Mingma T. Sherpa, Craig D. Steinback, Ken D. O'Halloran, Cassandra E. Nysten, Tom D. Brutsaert and Heidi Nysten

<u>Abstract</u>

Ascent to high altitude, and the associated hypoxic ventilatory response, imposes an acid-base challenge, namely chronic hypocapnia and respiratory alkalosis. The kidneys act to compensate this respiratory alkalosis via bicarbonate (HCO_3) excretion in urine, inducing metabolic acidosis. The time course and extent of plasticity of this important renal response during incremental ascent is unclear. We developed a practical index of renal reactivity (RR), indexing the relative change in arterial HCO₃ concentration ([HCO₃⁻]_a; response) against the relative change in arterial partial pressure of CO₂ (PaCO₂; stimulus) during ascent (RR= Δ [HCO₃]_a/ Δ PaCO₂). We sought to assess if RR increased over time and with incremental ascent to altitude, and if RR was correlated with relative changes in arterial pH (ΔpH_a) throughout ascent. During ascent to 5160m over 10 days in the Nepal Himalaya, arterial blood was drawn from the radial artery for measurement of acid-base variables (portable blood gas/electrolyte analyzer) in lowlanders at 1045/1400m (baseline) and at four altitudes following one-night sleep: 3440m, 3820m, 4370m and 5160m. At 3820m (day five) and higher, RR significantly increased and plateaued in comparison to 3440m (day three; P<0.04), suggesting plasticity in renal acid-base compensation. At all altitudes, we observed a strong correlation (range: r=-0.71 to -0.98; P<0.001) between RR and relative ΔpH_a from baseline. In conclusion, renal compensation increased and plateaued after five days of altitude exposure, despite subsequent exposure to higher altitudes. The extent of plasticity and plateau in renal responsiveness may predict severity of altitude illness or acclimatization at higher or more prolonged stays at altitude.

Keywords: acid-base balance; renal compensation; respiratory alkalosis; metabolic acidosis; high altitude

Supervisor: Trevor Day

Poster #1006, Presentation Time: 10:00 am - 12:00 pm

Abstract title: That's the mCherry on top of Mutating Fluorescence Proteins

Authors: Andrew Michael

Abstract

A central idea for research in cell imaging has been on generating new molecules for labeling protein or other macromolecules to be able to image them in living cells. Fluorescent proteins are one such set of labels because they can be genetically encoded into cells to form fusion proteins - allowing the localization of a protein of interest using fluorescence microscopy, while maintaining protein function. Monomeric red fluorescent proteins (mRFPs) are good candidates for further improvement because the longer wavelengths of light they fluoresce at is advantageous in biological material since they have decreased light scattering, and autoflourescence of the tissue is reduced. mRFPs however have low fluorescent efficiency, often referred to as quantum yield. This may be due to the non-planarity of the chromophore. mRFPs, such as mCherry, have an apparent weakness in the structure of the beta -barrel between strands which leads to increased oxygen permeability and quenching of fluorescence. The goal of this project was to explore the effects of altering a region on the structure of the mCherry fluorescent protein. Two amino acids in mCherry, glutamate-144 and histidine-172 share a hydrogen-bond. Breaking the H-bond between these two will be done through site directed mutatagenesis of histidine-172 to leucine. I predict that this result in a long-Stokes shift, caused by the potential for excited state proton transfer, between the excitation/emission spectra or the residue glutamate-144 will rotate into the hydrophobic interior which can alter the planarity of the chromophore thereby altering the quantum yield and red-shift the spectra.

Keywords: Fluorescence; Fluorescent protein; mutations

Supervisor: David Bird

Poster #1007, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: The effects of vitamin A, C and D on the expression of α B-crystallin in the lens of an embryonic chick

Authors: Jeena Lorida

<u>Abstract</u>

alpha B-crystallin is a small heat shock protein with a molecular weight of 20-22 kilodaltons typically expressed in lens epithelium on the anterior portion of the lens. Previous studies have shown that injury or stress can alter the structure of alpha B-crystallin, which can then lead to opaqueness (cataracts). A mixed vitamin diet or vitamin A alone can affect alpha B-crystallin expression. However, the specific effects of vitamin C on alpha B-crystallin are still unknown. High doses of vitamin D have implications in reversing cataract formation in clinical studies. The aim of this study was to determine the effect of a single dose of vitamin A, C or D on alpha B-crystallin in the lens of an embryonic chick eye. Alpha B-crystallin is expressed in the lens placode of chicks at an early stage of embryological development of the lens. In this study, embryonic chicks were exposed to 5 mu L of either mineral oil with no vitamin (n = 20), 770 mcg/mL of vitamin A (n = 21), 80 mg/mL of vitamin C (n = 21), or 15 mcg/mL of vitamin D (n = 20) at E14 for a 48-hour period. Immunohistochemistry and western blot analysis was performed

on these lenses to qualitatively visualize the expression of alpha B-crystallin following vitamin or mineral oil exposure. It is expected that the intensity of the alpha B-crystallin expression will be greater for the vitamin groups compared to the control group. This could imply that vitamins can reduce or delay the risk of cataract development.

Keywords: lens; cataract; vitamin; α B-crystallin

Supervisor: Carol Armstrong

Poster #1008, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Characterization of the mCherry fluorescent protein

Authors: Brittney Steer

Abstract

In microscopy, fluorescent proteins are used to visualize the location of proteins within living cells. The mCherry fluorescent protein, a derivative of mRFP, absorbs yellow-orange light (587 nm) and emits red light (610 nm). At position 109, glutamine forms a hydrogen bond with the fluorochrome, which contributes to this red fluorescence. Using site-directed mutagenesis, I will replace glutamine-109 with glutamic acid in the mCherry fluorescent protein. Glutamine and glutamic acid are the same physical size, differing only in that the former has a positively charged amine group, while the latter a carboxylic acid, which has a negative charge under neutral pH. The negative charge interferes with its ability to interact with an oxygen atom in the fluorochrome. Thus, the replacement will result in the loss of the hydrogen bond with the fluorochrome, possibly leading to a misfolded protein and altered fluorescence. By expression of the mutant mCherry in E. coli, I will characterize the excitation and emission fluorescence using fluorescence spectroscopy. From this experiment, I will be able to inquire about the role of glutamine-109 that is believed to anchor the fluorochrome and to determine if the glutaminemCherry bond is necessary for efficient fluorescence. Overall, I predict that the glutamine-fluorochrome hydrogen bond in mCherry is essential for proper folding of the protein and that removing this bond will completely inhibit the fluorescence as a result of misfolding. These results should provide a further understanding of the structure of fluorescent proteins which can contribute to further improvements in these live-cell probes.

Keywords: fluorescent proteins; mCherry; site-directed mutagenesis; spectroscopy; molecular biology

Supervisor: David Bird

Poster #1009, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Elevated blood CO₂ increases anterior cerebral blood flow responses to the cold pressor test

Authors: Scott Thrall, Leah Mann and Brittney Herrington

<u>Abstract</u>

The cerebrovasculature is responsive to acute alterations in blood gases (e.g., CO_2) and blood pressure. The brain is relatively pressure passive, with acute increases in mean arterial pressure (MAP) driving increases in cerebral blood flow (CBF). The superimposition of dynamic increases in MAP and controlled CO_2 perturbations on the regulation of anterior and posterior cerebral circulation is unclear. We aimed to characterize the effects of cold pressor test (CPT) on the anterior and posterior (middle and posterior cerebral arteries; MCA, PCA) with a background of different steady-state CO₂ perturbations. Twelve healthy participants were instrumented with electrocardiogram, finometer, mouthpiece/noseclip, and transcranial Doppler ultrasound (TCD) for measurement of MCA and PCA velocity (MCAv, PCAv). End-tidal CO₂ was measured using calibrated CO₂ analyzer. In a randomized order, a CPT was administered using 0-2°C water immersion of the lower limbs for 3-min under three coached, normoxic, steady-state end-tidal PCO₂ conditions: normocapnia (eupnea), hypocapnia (-10 Torr) and hypercapnia (+8 Torr). The CBV responses were calculated as the absolute difference (delta) between baseline and the mean MCAv and PCAv during the 3-min CPT. The delta MCAv response was larger in the hypercapnic trial compared to normocapnia and hypocapnia (P=0.007), but there were no differences in the PCAv. The delta MCAv CPT response was larger than the delta PCAv during the hypercapnic trial (P=0.004), but there were no differences between MCAv vs. PCAv in the normocapnic and hypocapnic trials. Our data demonstrate that there was differential regional permissive hyperemia when acute increases in MAP and steady-state CO2 are superimposed.

Keywords: Hypocapnia; Hypercapnia; Cold pressor test; Cerebral blood flow

Supervisor: Trevor Day

Poster #1010, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Distribution of Resilin in the Wings of Bumble Bees (Bombus spp.)

Authors: Vijata Sharma and Robin Owen

<u>Abstract</u>

Resilin is a protein which has extraordinary elastic properties. It plays an important role in insect wings allowing flexibility along joints crucial for flight, and is located at certain intersections of the wing veins. To date the distribution of resilin has been mapped in only one species, Bombus impatiens. We compared the distribution of resilin in males and females of six additional species in a variety of subgenera, and we also looked at intraspecific variation. We found very little intraspecific variation. We found some differences between species, but generally the major locations were the same in most species. Given that morphometric analysis of bumble bee wing venation patterns differentiates species, our results suggests that that the location of resilin in the wing plays an important mechanical role for flight.

Keywords: bumble bees; resilin; distribution; species

Supervisor: Robin Owen

Poster #1011, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Glucose tolerance is unchanged during acute normobaric hypoxia

Authors: Jason Chan, Trevor Day, Craig Steinback, Margie Davenport, Mackenzie Kozak, Garrick Chan, Alexander Rimke and Alexandra Chiew

<u>Abstract</u>

Blood glucose regulation is critical to support metabolism, particularly in contexts of metabolic stressors (e.g., high altitude). Data regarding insulin sensitivity and glucose tolerance in hypoxia are scant and inconclusive. We aimed to characterize the interactive effects of acute normobaric hypoxia and glucose regulation following an oral glucose tolerance test (OGTT) compared to normoxia. Following 12 hours of fasting on two separate days, 28 healthy participants (21.8 ± 0.3 yrs; BMI 22.8 ± 0.48 kg/m²; 16 females) were randomly exposed to either normoxia ($F_1O_2 0.21$) or hypoxia ($F_1O_2 0.148$) in a normobaric hypoxia chamber. Blood glucose was tested from finger capillary samples via glucometer and sterile lancets. Following a 10-min baseline in normoxia or hypoxia, participants consumed an OGTT (75g, 300ml) and blood glucose was sampled every 10-min for 80-min. Peripheral oxygen saturation was lower at baseline in hypoxia (88.6±0.7 vs. 96.8±0.41%; P<0.0001), but fasted blood glucose was not different between trials (hypoxia=4.86±0.07 vs. normoxia=4.80±0.08 mmol/L; P=0.47). Blood glucose responses following OGTT were compared between oxygen conditions using a two-factor repeated measures ANOVA (2FRM-ANOVA; factors = oxygen condition x time) and area under the curve (AUC; paired t-test). Blood glucose responses were not different between trials (2FRM-ANOVA interaction, P=0.765; AUC normoxia vs. hypoxia, P=0.227). We conclude that glucose tolerance is unchanged with acute normobaric hypoxia, likely protecting the metabolic rate of organs that do not require insulin for uptake or storage (e.g., brain) during hypoxic stress.

Keywords: Glucose; Hypoxia; Glucose Regulation; Glucose Tolerance;

Supervisor: Trevor Day

Poster #1012, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Effects of Lead Exposure on Neurodevelopment

Authors: Kaman Sandhu

Abstract

This research investigates the impact of lead exposure on perinatal and postnatal neurodevelopment in the cerebellum and the hippocampus. In 2014, over 100,000 residents of Flint, Michigan were exposed to high concentrations of lead in their drinking water. In fact, their water contained 15 times more than the acceptable limit according to the Environmental Protection Agency. Lead is known to impact kidneys, bones, liver as well as the brain. Specifically, perinatal exposure to lead affects the cerebellum, a region of the brain involved in cognition and motor coordination, and the hippocampus, which is involved in learning and memory. Based on the literature, it appears that lead impacts synaptic function and neurotransmission, cellular morphology, as well as cell survival in these regions. Research has found that lead exposure inhibits the enzyme activity of acetylcholinesterase within the cerebellum and hippocampus. As acetylcholinesterase plays a significant role in catalyzing the breakdown of the neurotransmitter acetylcholine, a loss of motor coordination and cognitive functioning is observed. In addition, lead exposure resulted in a loss of granule cells in the cerebellum and in the dentate gyrus of the hippocampus. Within the CA1 region of the hippocampus, pyramidal cells had irregular nuclei, chromatin clumping and deep invaginations within the nuclear membrane suggesting programmed cell death. Indeed, lead exposure upregulates the cell death protein Bax within the cerebellum and hippocampus, and is accompanied with an increase in the protease caspase-3, which plays a central role in the execution of programmed cell death.

Keywords: lead exposure; cell death; synaptic function; cellular morphology

Supervisor: Carol Armstrong

Poster #1013, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Calbindin Protein Expression in the Embryonic Chick Cerebellum in Response to Vitamins A and D

Authors: Krystal Nicor

<u>Abstract</u>

Regulation of calcium by intracellular calcium-binding proteins is important in the maintenance of neuronal function. Calbindin-D28k protein (CaBP) is a 28-kilodalton calcium binding protein expressed in Purkinje cells of the chick cerebellum as early as embryonic day (E) 10. Previous studies have suggested that exposure to vitamins A and D may affect expression of CaBP in the developing brain. This study aims to determine the effects of vitamins A and D on CaBP expression within cerebellar Purkinje cells. Embryonic chicks were windowed at E14 and exposed to 5ul of either 770 mcg/mL vitamin A, 15 mcg/mL vitamin D or mineral oil and then harvested 48 hours later. Calbindin expression was determined through western blot analysis and immunohistochemistry. Based on studies of CaBP transcription, it is expected that vitamin A-exposed cerebella will show an increase in CaBP expression while vitamin D-exposed cerebella will produce expression similar to that of control (mineral oil). Imbalances in CaBP are implicated in aging and neurodegenerative diseases and studies from other regions of the brain indicate that vitamin D may be neuroprotective, making it critical to further our understanding of CaBP regulation in response to vitamins within the embryonic chick cerebellum.

Keywords: Calbindin; Vitamin A; Vitamin D; Purkinje Cell; Cerebellum; Western Blot; Immunohistochemistry

Supervisor: Carol Armstrong

Poster #1014, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Quantification of Tissue Specific Expression of ABC type B transporters in Eschscholzia californica

Authors: Jonathan Roveredo, Perpetua Uzuegbu and David Bird

<u>Abstract</u>

Adenosine triphosphate (ATP)-binding cassette (ABC) transporters are a diverse superfamily of transmembrane proteins found in all eukaryotes. These proteins couple the hydrolysis of ATP to the transport of a wide variety of substrates across cellular membranes. In plants, ABC type B (ABCB) transporters have been shown to be involved in the transport of both growth regulators (auxin) and secondary metabolites. Plant secondary metabolism refers to the vast array of small molecules being produced, but not directly required for plant growth and development. However, secondary metabolites have been shown to play important roles in plant defense, such as in deterring herbivory or resistance to pathogens. It has been shown that transport between cell types is necessary in the biosynthesis of many of these metabolites and that ABC transporters play a necessary role in this trafficking. Eschscholzia californica, or the California poppy, accumulates alkaloids within specialized cells within roots. Our lab previously identified EcABCB1, a transporter involved in the transport of these alkaloids. In this project, using the recently-released draft genome of E. californica, we have identified seven additional putative ABCB transporters (ABCB2-7). Using quantitative polymerase chain reaction (qPCR), we will quantify their expression profiles in a tissue-specific manner. These results will then be used to draw inferences of the function of each candidate gene, based on comparative analysis of expression profiles of ABCB homologs in Arabidopsis thaliana. Expression profiling of these ABCB transporters will help to obtain a better understanding of alkaloid biochemistry in Eschscholzia californica.

Keywords: Biochemistry, Secondary metabolism, ABC transporters

Supervisor: David Bird

Poster #1015, Presentation Time:

Abstract title: Blue-shifting mCherry Excitation and Emission Maximas using Site Directed Mutagenesis

Authors: Lauren Gordon, Michael Cordara, Clifford Pasion and Mataya Van Heyst

<u>Abstract</u>

Fluorescent proteins (FPs) are valuable tools in live-cell imaging to localize proteins of interest. The mCherry FP is a mutated variant of Discosoma sp. (DsRed), and can be characterized by its emission and excitation wavelengths of 610nm and 587nm, respectively1. The mfruits are a series of mutants derived from the monomeric red fluorescent protein (mRFP1), developed from the dsRED tetramer, by the Tsien lab in 20042. They cover the green to red range of the fluorescent spectrum, offer higher photostability and complete chromophore maturation compared to mRFP12. We employed site-directed mutagenesis to introduce specific mutations into the mCherry FP at positions 66, 67, and 146. Position 66 and 67 comprise the fluorophore, thus mutations at these positions should most significantly alter fluorescence. Methionine at position 66 (M66) will be replaced with either threonine (M66T) or cysteine (M66C) and we predict will result in blue-shifted fluorescence1. Tyrosine at position 67 (Y67) will be

replaced with a tryptophan (Y67W). Y67W is one of the changes found in mHoneydew (a yellow-green FP); we predict that by introducing this mutation into mCherry, the fluorescence will be likewise blueshifted1. Finally, Serine 146 will be replaced with tyrosine (S146Y). We predict that S146Y will stabilize the fluorophore, maintaining the hydrogen bond as does serine, but should slightly alter fluorophore positioning given its larger size. We further intend to combine the mutations to see how S146Y, Y67W, and M66T or M66C will affect fluorescence when combined, predicting that together these mutations will result in blue-shifted fluorescence.

Keywords: mCherry; fluorescence; mutation; blue-shift; fluorophore

Supervisor: David Bird

Chemistry

Poster #1100, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Effect of Crowding Agents on the Uncompetative Inhibition of Alkaline Phosphatase

Authors: Michael Cordara

<u>Abstract</u>

We aim to determine the effects of crowding on uncompetitive inhibition enzyme kinetics to better understand the behavior of enzymes in natural cell environments. The natural environment of a cell is typically not well represented by in vitro experiments. One significant reason for this misrepresentation is the lack of crowding agents in typical in vitro studies. Much of what is currently understood about enzyme kinetics is derived from dilute or crowding-free reaction environments. Uncompetitive inhibition is a form of enzyme inhibition in which the inhibitor binds to the enzyme-substrate complex, preventing the formation and release of product. Although this type of inhibition is well understood in dilute solution, the effects of crowding on this type of inhibition is largely unexplored. In this study, the effects of two different crowding agents (Dextran & polyethylene glycol) on the uncompetitive inhibition by phenylalanine of 4-nitrophenol phosphate hydrolysis by alkaline phosphatase is examined.

Keywords: alkaline phosphatase, uncompetative inhibition, crowding, Michaelis-Menten,

Supervisor: John Chik

Poster #1101, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Improving confidence and performance at communicating in chemistry

Authors: Andrew Roberts, Michael Wentzel, Isaiah Ripley, Layne Morsch, Benita Ekwonwa, Brett McCollum and Vinita Kumar

<u>Abstract</u>

Students struggle with both verbal (Bhattacharyya and Harris, 2017) and symbolic (Flynn andFeatherstone, 2017) communication of chemistry concepts. A learning intervention was designed tohave organic chemistry students practice course concepts using proper chemistry language with aremote peer over video conferencing. Based on results from the first year of data (McCollum et al., submitted; Skagen et al., 2018), the intervention was expanded to include three universities, two inthe United States and one in Canada. All students were assigned an international partner for a set of6 weekly online collaborative assignments (OCAs). The research question of the study was: how does chemistry communication practice with aninternational partner impact learners' communication confidence and performance? Data sourcesincluded exam responses and grades, other course artifacts, semi-structured interviews, studentwritten reflections, and surveys on the OCA experience (Skagen et al., 2018). We report on howstudents described their ability to communicate using the language of chemistry, and the impact thatthe OCAs had on their confidence. These results are compared with performance metrics fromshared examination questions on reaction mechanisms.

Keywords: Chemistry communication; collaborative learning; communication confidence; performance

Supervisor: Brett McCollum

Poster #1102, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Sunscreen Dendrimers.

Authors: Yelizabeta Dmitriev, Benny Rana and Ashan Ayub

<u>Abstract</u>

Longevity and effectiveness of sunscreens and other UV-protectant lotions have been studied and researched for upwards of 90 years. Sunscreen lotions have been linked with prevention of a number of genetic mutations that may lead to skin cancers. The effectiveness of sunscreens is generally measured as Sun-protection Factor (SPF), which describes the minimal time that a sunscreen product can provide protection. Despite many advances in the field most sunscreens fail to deliver their claimed SPF protection. This is normally a result of human error; either in the amount applied, or the process of application. The focus of this research has been to investigate the use of second-generation dendrimers to increase the quantity of active sunscreen molecules present after application. Dendrimers, with their highly manipulatable physical and chemical properties, enable us to increase the "stickiness" of a sunscreen. This experiment focuses on finding optimal conditions to form a second generation sunscreen dendrimer, and to test whether the sunscreen will retain its protective function in this context.

Keywords: Sunscreen; Denrimers;

Supervisor: Nathan Ackroyd

Poster #1103, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Air Quality: A wicked problem affecting the world.

Authors: France Cleo Villanueva and Geraldhine Lopez

<u>Abstract</u>

Air Quality is the condition of the air within our surrounding. A good air quality level means that the air is free from pollutants, such as smoke, dust and other gaseous impurities in the air. Air Quality is measured using indicators, such as Air Health Indicator, Air Pollutant Emissions Indicator among others. The different levels of air quality health index (AQHI) are color-coded in their corresponding numbercategories. There are different key drivers for air pollution in developed and developing countries. For example, it was found that the higher the Gross Domestic Product of a country, the AQHI Level tends to be lower. This research is focused on the different factors and various impacts of air pollution in developed cities, such as Calgary, Alberta, Canada that falls under the Moderate Health Risk, in comparison to developing cities, such as Jodhpur, Rajasthan, India that falls under the Poor Air Quality. It appears that regardless of the source of air pollution, the impacts on the human population, environment and the economy will be the same.

Keywords: Air Quality, Air Pollution, Canada, India, Developed Countries, Developing Countries

Supervisor: Ravdeep Batth

Environmental Science & Sustainability

Poster #1300, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Effects of marine traffic on bowhead whale distribution and abundance

Authors: Natalie Hoa

<u>Abstract</u>

Over the past couple decades, there has been a steady increase in marine traffic in the Arctic. This increase in human activity may affect the abundance and distribution of bowhead whales (Balaena mysticetus). Comparisons of bowhead distributions from 1985-1999 and 2000-2014 suggest that, while the total number of recorded sightings during these time periods were similar, there have been changes in the time of year that bowhead whales are being observed. For example, from 1985-1999, most recorded bowhead occurrences were in September, and there were no recorded sightings in July and August. From 2000-2014, the number of sightings in September decreased dramatically while July and August showed the most recorded sightings. These changes suggest that increased marine traffic is altering bowhead whale distribution patterns in the Arctic.

Keywords: conservation; biology; wildlife; environment

Supervisor: Melanie Rathburn

Poster #1301, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Adaptation of a Microbial Fuel Cell to a Model Wetland System

Authors: Taylor Vodopija, Anne Neumann, Justin Cyr, Curtis Pridham and Allie Schumann

<u>Abstract</u>

Wetlands are environmentally significant, but currently have limited immediate economic value. Wetland soils are permanently anaerobic, and in these environmental conditions bacteria utilize organic material to produce energy. Oxygen is highly electronegative and readily bonds to the free electrons in the soil. The removal of oxygen in the system creates a free flow of electrons and can be used to generate power. Wetland plants fix atmospheric carbon into biomass above and below the soil during photosynthesis. Carbon is also deposited into the soil through rhizosphere excretions in the form of litter. This study was conducted to determine if the presence of common horsetail (Equisetum arvense) is correlated with an increase in Microbial Fuel Cell (MFC) voltage production. The effect of a plant on the electrical productivity was investigated through a comparison of model wetlands with and without E. arvense present. It is expected, the presence of common E. arvense will produced more energy in a MFC than a cell with no vegetation. The cells are located in the greenhouse of Mount Royal University. Current measurements have suggested that there is a trend showing higher voltage production in the microbial fuel cell with E. arvense. Further data collection is still ongoing to determine if the current trend continues.

Keywords: Wetland; Energy; Microbial Fuel Cell; Plants

Supervisor: Mathew Swallow

Poster #1302, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Hydrophobic Soil - Root system influence upon disintegration of hydrophobic layer, analyzed through Infiltrometer testing

Authors: Jordan Chu, Duncan Shipley, Caitlin Sexton, Megan Kraus, Mitchell Barnes and Greta Vela

<u>Abstract</u>

Coniferous trees and organic matter under incomplete combustion can create a hydrophobic layer in the soil surface. In the aftermath of a forest fire, the volatile inorganic hydrocarbon by-product coats the surface of large soil particles in coarse substrate, and varies depending on the soil texture. Thereby, creating the hydrophobic layer which prohibits the infiltration of water into the soil profile resulting in severe run-off and sedimentation. Atop the hydrophobic layer exists a hydrophilic soil horizon, allowing for seeds to germinate and grow. The germination process will lead to root systems penetrating the hydrophobic layer and ultimately creating conduits for water infiltration. Vegetation with taproot and fibrous root systems will promote quick and deep penetration of the soil profile through a main channel; allowing for the movement of water and nutrients past the hydrophobic layer. Vegetative remedial strategies may be a viable method of degrading the hydrophobic layer and mitigating the negative environmental effects of a forest fire. This investigation focuses on vegetative strategies to create root infiltration channels from two different plant species: Dactylis glomerata and Papaver nudicaule. The seeds will germinate above a simulated hydrophobic layer and subsequent rooting behaviour will be investigated on the efficacy of breaking through the hydrophobic layer. The ability of the different root

systems to penetrate the hydrophobic layer will be measured using an Infiltrometer test. The tap root systems are expected to penetrate the hydrophobic layer more effectively than the fibrous root system applied in this experiment.

Keywords: Hydrophobic Layer; Fibrous Root Systems; Tap Root Systems; Run-off; Remediation; Forest Fire; Infiltration; Sedimentation; Soil;

Supervisor: Mathew Swallow

Poster #1303, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: The Effect of Microplastic on Soil Infiltration Rate

Authors: Kevin Cho, Matthew Mikkelson, Kevin Hayes, Clifford Pybus and Jesse Elcombe

Abstract

The increased and extensive uses of plastics, as well as their resilience to degrade in the natural environment has resulted in the accumulation of the material in both the aquatic and terrestrial environment (Costa et al, 2016). When the plastic particles reach a size of less than 5mm in their largest dimension, they are considered to be microplastics (Duis & Coors, 2016). Microplastics create several issues within the environment, namely that they can be eaten by organisms, and therefore bio-accumulate in the food chain, and can form a surface to which pollutants can accumulate (Rillig, 2012). The focus of microplastics research has been predominantly towards the aquatic environment, which leaves several questions to be answered about the impacts of microplastic in the terrestrial environment (Rillig, 2012). Possible entrance vectors of microplastics into the terrestrial environment include urban wastewater treatment and the subsequent discharge /injection of the sewage sludge, the accidental loss of industrial raw materials such as pellets or powders during transport (GESAMP, 2010). In relation to practical usability, Nizetto, Futter and Langaas (2016) stated that the spreading of sewage sludge containing microplastics is commonly practiced to promote crop fertilization in agricultural practice. More than 90% of microplastics are contained in sludge post water treatment, therefore, the microplastics will be distributed over the farmland (Nizetto et al., 2016). The theory that microplastics increase the water repellency of a soil is what will be examined in this research. Larger plastics have been demonstrated to be beneficial, at least in the short term, to plant growth and soil moisture (Steinmetz et al, 2016). However, it is still unclear what impacts these plastics will have when they break down or are injected into the soil as manufactured microplastics in wastewater sludge (Steinmetz et al, 2016; Zubris and Richards, 2005). Glitter is a common microplastic; it is found in a wide variety of cosmetic and decorative products (Wilhelm, 1998). Glitter is underrepresented in the research as a microplastic pollutant, as such, it is the intention of this research assist in closing the gap in this knowledge by determining if this microplastics addition to soil will have an effect on the infiltration rate as compared to glitter free soil. The results of this research will be analyzed statistically using ANOVA and Levene's test methods.

Keywords: Infiltration; agriculture; environment; saturation; sludge;

Supervisor: Mathew Swallow

Poster #1304, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Comparison of a crystallization inhibitor and gypsum flushing for treatment and remediation of brine affected soils

Authors: Sydney Davenport, Tim Kruchkowski, Simone Rodger, Alex Coombs and Darla Frank

<u>Abstract</u>

Produced water, also known as brine, contains high concentrations of sodium chloride (NaCl) and is a common byproduct of oil and gas operations in Alberta. When brine contaminates soil, it causes the breakdown of soil aggregates, increases soil erosion, and decreases hydraulic conductivity. Commonly used methods, such as chemical amendments, can be technically and economically restrictive and often does not effectively remove salt. Gypsum is the most frequently used amendment for saline affected soils due to its availability and low cost, while crystallization inhibitor is still a relatively new treatment method. The crystallization inhibitor is composed of ferric hexacyanoferrate, which produces harvestable, non-crusted NaCl efflorescence from the surface of brine-contaminated soil columns. Our study will compare crystallization inhibitor to gypsum to determine which in-situ treatment method is more effective in removing sodium from brine affected soil. NaCl removal rates will be compared by determining electrical conductivity (EC) and mass balance values of treated soils. Both remediation methods have been studied but have not been directly compared to one another. We hypothesize that the crystallization inhibitor will be more effective than gypsum flushing as an immediate treatment for removing brine contamination.

Keywords: Produced Water Soil Remediation; Treating Brine Affected Soils; Crystallization Inhibitor; Gypsum Flushing; Immediate In-Situ Treatment; Oil and Gas

Supervisor: Mathew Swallow

Poster #1305, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Soil Saturation by Capillary Action: An Alternative to Saturated Paste and Soil-Water Suspension

Authors: Charde Clark, Anya Batycky, Eduard Seleznov, Jeremy Duckworth and Ty Malowany

<u>Abstract</u>

The standard method currently used for saturating soil is the saturated paste method as it best simulates the chemical environment plants experience. It works by adding water to a soil sample and stirring until a paste is formed. However, the most common method is soil-water suspension, as it utilizes a mixture of water and soil defined by predetermined ratios to saturate a sample. Both methods are currently widely accepted within the soil science community. Saturated paste method is limited by its subjective nature, as it lacks exact measurements and reproducibility. A limitation of the soil-suspension method is that it does not accommodate for soil texture of a sample, as uniform ratios are used for varied soil types. Our research proposes a new method for determining EC and pH by saturating soil utilizing natural cohesive and adhesive forces of water to saturate soil. The use of paper towel to create a conduit between a water reservoir and soil sample allows for soil saturation through capillary action, without disrupting the soils structure. This method would be more effective in measuring pH and EC as it preserves soil structure, mimicking the natural water capacity of the soil found in-situ, yielding more representative measurements. Our new method will be more convenient than the saturated paste as it can be conducted by users of various expertise. This method could be set up on various scales allowing for simultaneous soil saturation.

Keywords: Soil Saturation; EC; pH; Capillary Action

Supervisor: Mathew Swallow

Poster #1306, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Determining the effects of a simple carbon source versus a complex carbon source on aggregate formation, microbial activity, and the accumulation of organic matter content

Authors: Tina McLean, Kayla Kanwischer, Benton Dalgleish, Derek DiMarzo, Michelle Harris and Mercy Maina

Abstract

Soil formation is the result of the development of a complex microbial community and accumulation of organic matter which alters the characteristics of the original mineral components. Over time, binding agents produced by microbial activity and decomposition of organic matter cause soil particles to group together as aggregates. The rate of aggregate formation is attenuated by many factors including the clay content, temperature, moisture, and wet-dry cycles. Aggregate formation creates structure within the soil profile which is essential for the development of pore space. Pore space promotes the infiltration of surface precipitation and is necessary for gas exchange required by vegetation and microbes. We investigated whether the addition of a simple carbon source in the form of glucose could result in the formation of aggregates or whether a more complex source of organic matter in the form or barley powder would be required. Glucose and barley powder were added to samples of a mineral composite of 96% sand with 4% clay and inoculated with microbes extracted from a viable grassland soil. Samples were incubated at 360 C for 43 days with the moisture content of the samples maintained at approximately 45% water filled porosity. After the incubation period is complete, the following tests will be conducted: wet aggregate stability to determine if soil aggregates have formed, soil respiration to measure the microbial activity, loss on ignition to assess the accumulation of organic matter content, and pH.

Keywords: Soil formation; aggregate; carbon source; microbial activity

Supervisor: Mathew Swallow

Abstract title: The Effect of Plant Uptake of Ski Wax on the Growth Rate of Avena Sativa and Medicago Sativa

Authors: James Walker

Abstract

Ski waxes may be composed of fluorinated hydrocarbons or non-fluorinated hydrocarbons (paraffins). It is known that fluorinated compounds are toxic and can have a negative impact on the environment, it is not known if levels in ski waxes pose a risk. Greenhouse plant studies were completed to evaluate the potential of ski wax residues to impact plant health and growth. This was completed by exposing two environmentally relevant plant species to ski wax residue in soil at various stages of development, followed by collection and analyses of samples (soils and plants), and statistical analyses of data. Control plants were included and were handled in the same manner however they were cultivated in clean soil. Avena sativa (Cat grass) and Medicago sativa (Alfalfa) were grown from seed in soil impacted with one of two types of liquid ski wax, non-fluorinated and fluorinated. Additionally, snow melt from Canada Olympic Park was collected to represent environmental relevant ski was impacted sources. Plants were cultivated in low, medium, and high concentrations and growth parameters including germination and shoot height were assessed. The growth of each plant was monitored for 22 days. Plant and soil samples were collected, dried, extracted using liquid-liquid extraction, cleaned using solid phase extraction and analyzed on a gas chromatography mass spectrometry to determine the levels of ski wax in soil and plant samples. The wax did not have a significant effect on the growth of A. sativa however M. sativa was affected by increasing concentrations of wax in the soil.

Keywords: Ski Wax; Environmental Impact; Sustainability; Plant Growth

Supervisor: Gwen O'Sullivan

Geography & Spatial Analysis

Poster #1400, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Google Earth Virtual Field Trip for the Monashee Basement Core Complex, B.C.

Authors: Joseph Temones

Abstract

One of the great challenges for the novice geologist is to acquire the spatial visualization skills necessary for their futures as professional geologists. While virtual field trips will never replace the learning experience of a real field trip; potentially they could be used to facilitate the acquisition of these spatial visualization skills in the class room setting. The "blue marble" image taken from Apollo 17 (1972) changed the way that we can visualize our planet, leading eventually to the technological breakthrough of Google Earth that permits the viewer to explore through high-resolution graphics and satellite images of our planet. Besides the advantage of being a free platform, Google Earth permits the incorporation of cross-section views through geological features and microphotographs to permit the user to explore scales

from planet through an outcrop into the microscopic scales. Some of the most complex geological features in the Canadian Cordillera are the basement core complexes (e.g. Monashee Complex west of Revelstoke) where greater than three-billion-year-old basement rocks are exposed due to the cover rocks being removed by extensional movement along normal faults. Here digital geological maps, cross-sections and photomicrographs from the Monashee Complex and surroundings have been combined within Google Earth. This model will be used in the future to assist novice geology students with visualizing these complex geological features.

Keywords: Google Earth; Monashee; basement core complex; virtual field trip; British Columbia

Supervisor: Katherine Boggs

Geology

Poster #1500, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Differences in the Family

Authors: Jacob Lucyshyn

<u>Abstract</u>

The middle Cambrian Spence shale is named after the individual R.S. Spence who first showed interest in the formation in 1896, which later lead well-preserved fossils being sent to Dr. Charles D. Walcott who conducted a thorough investigation beginning in 1906 of the Bear River Range in southern Idaho. However multiple locations in the north-western United States including north-eastern Utah in the Wasatch Mountains show exposure as well. The samples collected for this study are from Spence Gulch area in Idaho. The member of the Spence Shale is characterized by paleoecological conditions consisting of rapid burial events with mild turbidites similar to that of the Burgess Shale. Although unlike the Burgess Shale the Spence shale contains no soft tissue, only mineralized skeletal portions and this can be attributed to the slope differential on which deposition occurred. This environment of deposition has left well preserved samples of Trilobites occur in high numbers. Multiple trilobite genera are represented including two species of agnostids: Pentagnostus Bonnerensis and Pentagnostus Brighamensis both of which occur in abundance in our samples. Upon further examination the notable differences between these two agnostids species are: the Pentagnostus Brighamensis has exhibited a shield that is more circularly shaped with a bulbous outline. Another distinguishing feature between the two species is a deeper transverse rhachial furrow in the pygidium; which is a direct result of the rear rhachis lacking penetration in the pleural lobe.

Keywords: Pentagnostus Bonnerensis; Pentagnostus Brighamensis; Spence shale; Trilobite; Rapid Burial

Supervisor: Paul Johnston

Poster #1501, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Metamorphism of Ophiolites in the Ocean Continent Transition of Northern Corsica

Authors: Joseph Lillis

Abstract

Alpine Corsica offers a wide range of complex metamorphism along with the opportunity to study an Ocean Continent Transition at the surface, rather than beneath the deep waters of the distal ocean. The ocean-derived 153 to 169 million year (Ma) old rocks of Alpine Corsica range from a continental margin in the west to the Schistes Lustrs (SL) ophiolite (slice through oceanic crust and underlying upper mantle) complex in the northeast. Cap Corse in northern Corsica consists of variably metamorphosed units derived from the Western Tethys Ocean folded together in a large antiformal structure. Metamorphism ranges from the blueschist facies (T~420°C, P~0.8Gpa) up to lawsonite eclogite facies (T~520°C, P~2.3Gpa). Sample 2018Y from the Morteda-Farinole-Volpajola unit in the SL ophiolite complex has 1-4mm thick layers of eclogite and blueschist layers; providing evidence for the original deep location of these rocks at the base of the crust (~80km deep), followed by Eocene (35 to 55Ma) subduction to 30-60km in depth due to Alpine plate convergence. This complex metamorphism in Northern Corsica is due to the late Mesozoic (70-100Ma) to current Cenozoic (70Ma to the present) Alpine orogeny where deeply subducted oceanic crust was thrust over continental crust to form the SL ophiolite complexes.

Keywords: ophiolite; blueschist; eclogite; Corsica

Supervisor: Katherine Boggs

Poster #1502, Presentation Time: 10:00 am - 12:00 pm

Abstract title: History and Movement of the Rocky Mountain Trench

Authors: Sarah Te Linde

Abstract

The Rocky Mountain Trench (RMT) is a very enigmatic morphological feature that can be seen from space. It extends more than 1600 km from Montana through British Columbia, possibly joining with the Tintina Fault system (TFS) in the Yukon, and into Alaska. The Yukon has 450 km of right-lateral (dextral) strike-slip (horizontal) movement along the TFS. In the southern area of British Columbia, near Golden BC, there is only space for up to 10 km of horizontal movement; with most movement occurring as extensional motion along much smaller faults in the RMT. The RMT also represents the boundary between the Foreland Fold and Thrust Belt (east) and the Omineca Crystalline Belt (OCB, west). Another interesting discrepancy about large scale tectonics in the Cordillera Orogeny is the apparent disagreement between paleomagnetic measurements. This suggests that there is at least 1100 km of motion required to bring the Coastal Mountains into their current position along the west coast, which can also be tied to the lack of significant strike-slip motion along faults within the southern Canadian Cordillera. One proposed solution was that the crust in the southern OCB was detached and rotated clockwise. The purpose of this project (a work in progress) is to experiment geometrically with possible offsets along faults that could be buried out of sight in the Liard Basin (northeastern BC, where the RMT

and TFS are supposed to join), and with different morphologies of the proposed detached rotating crust in the OCB.

Keywords: Rocky Mountain Trench; fault; mapping; Canadian Cordillera

Supervisor: Katherine Boggs

Poster #1503, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Losing its Cool: The Melting of Canada's Infrastructure

Authors: Abbey Rippenhagen

<u>Abstract</u>

The inevitable quickly warming climate in Canada north of the 60th parallel has begun to cause many serious issues such as those resulting from the melting permafrost. The occurrence of polar amplification increases the threat of Canadian communities remaining unprepared for the imminent infrastructure damages that will occur. This raises the question as to what extent of damages, both in severity and locality, will ensue with relation to the types of ground ice and the concentration of structures, such as roads, buildings, runways, and pipelines within the vicinity. The identification of cryogenic landforms and issues resulting directly and/or indirectly from this warming provides a better understanding of the urgency needed in preparing the framework to minimize damage caused by changing drainage patterns, structural imbalances, shifting ecosystems, and the development of irregular topography. The compilation of information from construction projects, repair work, and other activities produces a useful database to begin the analysis of problems associated with the degradation of ground ice bodies. Knowledge of how specific ground ice types will react to rising temperatures will help in selecting remedial measures for existing problems, and in choosing appropriate preventative measures for future construction. As well as providing a base level of understanding for infrastructure problems, this work will produce a first attempt to estimate the release of methane from warming organic permafrost terrain, which will exacerbate the warming trend.

Keywords: Permafrost; Canada; Infrastructure; Methane; Climate Change

Supervisor: Dana Naldrett

Poster #1504, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Tectono-metamorphic history of blueschist metabasite in Corsican ophiolite sequence

Authors: Elyse Marzolf

<u>Abstract</u>

The Mediterranean island of Corsica has a unique and complex tectono-metamorphic history involving the emplacement of two ophiolites. Sample 2018A contains chert and mafic fragments from the top sedimentary and pillowed basalt layers of the Schistes Lustrs ophiolite (slice through oceanic crust and underlying mantle). The mafic clasts contain the metamorphic minerals glaucophane + lawsonite which formed under low temperature blueschist metamorphism (200°- 500°C, greater than 0.6GPa) which

indicates an ancestral subduction margin (to a depth greater than 20 km). The presence of chert and mafic clasts, with the lack of serpentinite, in Sample 2018A indicate a sedimentary mélange origin for this sample. A mélange is a large scale breccia with a variety of rock fragments held by a fine grained matrix, typically associated with subduction zones. Nearby sample 2018J is a serpentinized peridotite from the mantle which represents the bottom of the Schistes Lustrs ophiolite sequence and provides evidence for seafloor metamorphism. The late formation of epidote in 2018A represents later metamorphism in the form of emplacement of the ophiolites on the oceanic-continental margin in Corsica.

Keywords: Corsica; Ophiolite; mélange

Supervisor: Katherine Boggs

Poster #1505, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Serpentine Melange in California Franciscan Complex

Authors: Douglas Toner

Abstract

The Franciscan Complex in California is an excellent location for studying ophiolites and tectonic mélanges associated with convergent subduction zones. A mélange is a large mappable breccia that contains both locally derived and exotic fragments, created due to the complex tectonic processes that occur at subduction zones. There are two types of mélanges - sedimentary and serpentine - where the serpentinized mélanges were buried deeper and are therefore more consolidated because of the higher pressures and temperatures. The presence of $\sim 80\%$ serpentinite in Sample 2018M indicates that this is from a serpentine mélange while Samples 2018F and 2018W are sedimentary because they are softer and contain several chert and mafic clasts which implies that these are from a sedimentary mélange. Sedimentary mélanges are thought to form during a submarine gravity slide off the continental slope. The Farallon Plate has been subducting under the western margin of North America for greater than 150 million years (Ma). When the divergent mid oceanic ridge on the Farallon Plate was completely subducted the divergent motion of this ridge was translated into the transform motion of today's San Andreas Fault. The presence of $\sim 80\%$ serpentine and lack of felsic minerals in Sample 2018M indicate that this sample was originally an ultramafic peridotite, from the basal layer of an ophiolite. Ophiolites are segments of oceanic plates with upper mantle that have been thrust upon continental plate.

Keywords: Mélange, serpentine, Franciscan complex, metamorphic, geology

Supervisor: Katherine Boggs

Poster #1506, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Creosote Contamination and Movement in Calgary, Alberta

Authors: Joseph Cloutier

Abstract

Creosote is a wood-preserving chemical composed of more than 250 organic compounds, consisting of polycyclic aromatic hydrocarbons, petroleum hydrocarbons, and volatile organic compounds. Many of these are carcinogens, causing major concerns to people living near the former Canada Creosote (Domtar) site in the West Village, Calgary, Alberta. While most contaminants there are from the creosote mixture, there are some contaminants that originate from operations other than wood treatment. Contaminant movement is complex and ongoing to varying degrees, and there is increasing concern regarding the cause of contaminant migration from the site to the north bank of the Bow River into West Hillhurst. When components are denser than water (DNAPL), they sink under the water, and then settle onto bedrock that they cannot penetrate. They then remain at the bedrock surface unless cracks, fractures, or scours are present. Migration is also affected directly by groundwater flow. The nature of the bedrock topography of the basal Paskapoo Formation, as viewed in this study in Calgary and the Cochrane area, affects the migration and spread of such contaminants. River terraces also contribute to channeling of groundwater flow and isolation of creosote in some locations. While flooding of the Bow River can affect spread of some LNAPL components, this is to a lesser extent than that of the heavier DNAPL fraction.

Keywords: Creosote; Contamination; Bedrock; Bow River; Flooding

Supervisor: Dana Naldrett

Poster #1507, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: A California Blueschist Nodule in a Serpentinized Mélange

Authors: Kiel Del Mundo

<u>Abstract</u>

The Franciscan Complex in western California is renowned and famous within the geological community for its complex tectonic setting, featuring ophiolites, blueschist metamorphism and tectonic mélange. Gorgeous blue amphiboles (as seen in sample 2018X) such as glaucophane, are typical of blueschist metamorphism and provide evidence of ancient subduction zones that experienced high pressure and low temperature metamorphism. The temperature range of approximately 100°C to 500°C is represented by blueschist metamorphism and represents an approximate subduction depth of 15-50 kilometers. It is worth noting that rocks are not the most ideal conductors to explain the relatively low temperatures preserved in blueschists. Mélanges are defined as mappable bodies of internally disrupted and mixed rocks in a pervasively deformed matrix and include two main types; sedimentary mélange and serpentinized mélanges. With that in mind, Sample 2018X is of a blueschist nodule collected from a serpentine matrix. Though Sample 2018X provides evidence for the ancestral subduction setting, it does not however provide evidence for the serpentanization process that rocks such as Sample 2018X's lack of feldspar content and abundance of glaucophane suggests that this sample metamorphosed from a mafic rock,

potentially an ocean floor basalt, which is typical of the top ophiolite complexes. Although this sample provides good insight into the metamorphic geology in this area, we need to examine multiple samples to completely understand the tectonic history of the complex regions such as western California.

Keywords: Blueschist; Metamorphism; Metamorphic; Subduction

Supervisor: Katherine Boggs

Poster #1508, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Archean veins of life: first signs of life attributed to heat and minerals at hydrothermal vents 3.6 billion years ago

Authors: Sheri May, Jenni Scott, Kory Tardiff, Shamus Harder, Jordan Shackman and Haley Fiedler

Abstract

The Eoarchean-Paleoarchean boundary at 3.6 Ga marks the time when the first protocells and amino acids originated on Earth. These compounds were the initial building blocks for RNA, Bacteria, and Archaea, which later evolved into all life - including humans. Through an assessment of published literature, we determined that life's origin required oceanic hydrothermal vents, following the theory that the necessary heat, energy, and minerals for essential organic molecules were provided by the vents. Although debate continues, the Panspermia theory fails to explain life's origin because we found that large molecules/bacteria are unable to exist in space. Although necessary conditions were present in the Eoarchean at \sim 4.0 Ga, life's origin dates to the Eoarchean-Paleoarchean boundary about 400 million years later. Eoarchean oceans were significantly warmer, and the heated water hydrothermal vents expelled was rich in dissolved minerals, and enabled organic chemosynthesis. Evidence from cherts from \sim 3.0-3.6 Ga demonstrates an alkaline, high-temperature environment. Submarine pillow basalts offered the conditions necessary for colonies of primitive life and nucleic acids to form through the presence of isotopically depleted carbon. Eoarchean atmospheric composition consisted of high levels of CO₂, NH₃, and CH_4 , with O_2 absent - the ammonia offering nitrogen for amino acid building when split through lightning. Chemosynthetic life liberated O₂, which oxidized minerals such as iron. Life's origin can only be theorized, however we believe that it was hydrothermal vents, and the supply of elements required for organic molecules, that played the most important role in the evolution of life on Earth.

Keywords: archea, life, hydrothermal vents, origin of life, prokaryote, hydrosphere, bacteria,

Supervisor: Jenni Scott

Poster #1509, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Blueschist Metamorphism in the Franciscan Complex

Authors: Cristian Otalora

Abstract

The Franciscan Complex accretionary wedge and mélanges, in western California preserve evidence of an ancient subduction zone. The accretionary wedge formed when a mass of material was scraped off the oceanic crust during subduction, and then accumulated at the edge of the overriding plate as the Farallon plate was subducted under North America. Mélanges are mappable bodies of internally disrupted and mixed rocks in a pervasively deformed matrix that is frequently serpentinized. Serpentinization is the metamorphic process by which ultramafic rocks are oxidized and hydrolyzed in relatively low temperatures to form serpentine. One source of serpentine for the Franciscan complex is the overlying Coast Range ophiolite sequence, a slice through oceanic crust with the underlying mantle now preserved on continental crust due to thrusting. Subduction of the Farallon plate is also marked by high temperature blueschist and eclogite metamorphism. Sample 2018T is a blueschist clast from a serpentinite matrix that contains glaucophane + garnet + epidote preserving evidence of a range of 200-500 C° and 0.6-1.7 GPa (representing subduction down to a depth of 15 - 20kms). During this subduction, directed pressures aligned the glaucophane blades to form a foliation and crenulation (metamorphic fabrics). As the sample was brought to the surface, decompression combined with fluids caused the garnets in sample 2018T to alter to chlorite. The minimal presence of felsic minerals combined with the glaucophane suggests that this rock was originally mafic, possibly from the upper basaltic pillow layer in the Coast Range Ophiolite.

Keywords: geology;metamorphism;subduction;bluschist;serpentinite

Supervisor: Katherine Boggs

Poster #1510, Presentation Time: 10:00 am - 12:00 pm

Abstract title: It was the abrupt decline in atmospheric CO2 ~34 Ma that led to Antarctic glaciers and the beginning of widespread Cenozoic glaciation.

Authors: Sasha Lewis, Trevor MacDonald, Rolando Lanto, Richard Tucker and Taryn Hinton

<u>Abstract</u>

The Eocene-Oligocene transition ~34 million years ago marks a major change in climate when Earth abruptly changed from a greenhouse to an icehouse period. At this time, ice growth on the continent of Antarctica, caused a major extinction in land plants and oceanic microorganisms. Based on our research from published literature, we think that the drop in atmospheric CO_2 levels at ~34 Ma is the primary factor contributing to the cooling of the Earth. At the end of the Eocene, there was a steep drop in atmospheric CO_2 , occurring over a one-million-year time span, when levels fell below a critical threshold of 750 ppm, followed by a brief sharp increase to pre-transition levels (~1000 ppm), and a continuous gradual decline over the following 20 million years. The exact cause of the CO_2 drawdown is still unknown. In addition to the decline in atmospheric CO_2 , major tectonic events like the opening of the Tasmanian gateway and Drake passage contributed to glacial expansion over Antarctica. These two events caused changes in ocean circulation that resulted in the formation of the Antarctic Circumpolar Current. Ocean water in the south Atlantic was then trapped in the circumpolar current, leading to rapid and

progressive cooling. The sudden change in climate during the Eocene-Oligocene transition is important to understand because it shows how abruptly Earth's climate can change when there is an increase or decrease in CO_2 levels.

Keywords: Eocene-Oligocene Transition; Glaciation; CO₂

Supervisor: Jenni Scott

Poster #1511, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Complex Metamorphic Conditions of Northern Corsica

Authors: Kate Nicas

Abstract

Northern Corsica is a fascinating region because of the complex tectonic relationships involving ophiolites, an exposed-on-continent ocean to continent transition and the preservation of multiple different metamorphic events. The complex relationships are due to the thrusting of an oceanic crust with underlying mantle peridotite on to continental material in a westward direction, forming an ophiolite sequence. Sample 2018V, from Dfil de Lancon, was originally a volcanic breccia from the crustal basaltic layer at the top of the Corsican ophiolite sequence. Eclogite cores to these breccia fragments preserve evidence of high pressure (1.2 to 1.6GPa) and high temperature (600 to 1000°C) metamorphism typical of the bottom of the crust, around 50km depth. These breccia fragment rims contain crossite which correspond to blueschist metamorphism (0.8 to 1.6GPa and 100 to 500°C); preserving evidence that this crust was rapidly subducted to depths up to 50km. Greenschist alteration in this sample occurred due to fluid flow and lower pressures (0.2 to 0.6GPa) and temperatures (300 to 500°C), as the Corsican ophiolite complex was emplaced onto the Corsican continental crust. The oceancontinent transition (OCT) is preserved west from the Dfil de Lancon, moving from the ophiolite complex represented by 2018V across north central Corsica onto the continental Tenda Massif. Such exposures of these OCT are not usually well preserved on continents because the oceanic component is usually out in the deep ocean.

Keywords: ophiolite; Corsica; volcanic breccia; eclogite; metamorphism

Supervisor: Katherine Boggs

Poster #1512, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Structural Controls on Epithermal Springs in Southeastern British Columbia

Authors: Connor Fornwald

Abstract

Geothermal energy in Canada is a largely unexploited resource with tremendous potential in the western provinces. Localities with high heat flow and deep circulation of meteoric waters that are quickly mobilized back to the surface are essential for producing geothermal power, as well as forming the discovery of epithermal (warm water, shallow depth) mineral deposits (lead, zinc). Understanding the structural controls on fluid circulation in natural hot springs is a necessity for geothermal exploration, and the understanding of hydrothermal ore forming processes. Radium, Fairmont, and Lussier hot springs parallel the western margin of the NW-SE trending Redwall Fault, suggesting that the Redwall Fault drives fluid migration within this epithermal system. Morphological characteristics which promote fluid flow along the Redwall fault can be attributed to large scale thrust faulting and ductile deformation, leading to fault-driven seismic pumping of thermal spring waters, as well as microscale fractures and diagenetic changes that created permeable conduits that enhanced meteoric water circulation. A zone of deformation >500m in width separates the area of greatest fluidized alteration from the current hot springs outlet. This indicates possible migration of the thermal spring system which may be linked to glacial isostatic adjustment, which refers to the regional uplift after glacial retreat \sim 12,000 years ago. Improved understanding of fault-driven epithermal systems such as the Redwall Fault will assist in improving our comprehension of possible geothermal energy producing systems, as well as act as a modern analogue for hydrothermal ore formation.

Keywords: Geothermal; Structural Geology; Hot Springs; Mineral Deposits

Supervisor: Katherine Boggs

Poster #1513, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Regional Fluid Flow Impacts on Magnesian Ore Deposits from Mount Brussilof, British Columbia: A Comprehensive 3D Model and Petrographic Analysis

Authors: Daniella Pietrocarlo

<u>Abstract</u>

Magnesite is an industrial mineral commonly used in the manufacturing of refractory materials (materials highly resistant to heat) used in furnaces, kilns, reactors, etc. The Mount Brussilof ore body of southeastern British Columbia is one of the purest carbonate-hosted magnesite deposits ever discovered. Found in 1965 by the Geological Survey of Canada, this world-class deposit has been mined as an open pit by Baymag Mines Co. Ltd. since 1982 and produces all current magnesite production in Canada. Mount Brussilof-type magnesite deposits are hosted within high-magnesium carbonates of the Middle Cambrian (513 - 499 million years) Cathedral Formation and are characterized by gorgeous pinolitic (pine-like) and zebra-like textures. Ore bodies are concentrated within the Kicking Horse Rim east of the Cathedral Escarpment (ancient continental margin), a location highly regarded for its famous Burgess Shale fossil lagerstätten (exceptional soft-bodied fossil preservation). There is much speculation regarding

the origin of the magnesite deposits in the Mount Brussilof area and whether the magnesite is primary in origin or the result of complete replacement (epigenesis) of the original sediments by either hydrothermal or diagenetic processes. This study supports an epigenetic replacement origin based on a comprehensive literature review and petrographic, electron microprobe and 3D fluid flow studies of a pinolitic magnesite sample from the Baymag mine. Pinolitic to rosette growth forms oriented perpendicular to reaction channels in this sample are interpreted as metasomatic replacement textures. Additionally, reaction channels do not follow sedimentary bedding, further implying that these channels formed after the sediments were deposited.

Keywords: magnesite; pinolitic; epigenetic; Cathedral Formation; Kicking Horse Rim; Cathedral Escarpment

Supervisor: Katherine Boggs

Poster #1514, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Lower Carboniferous Brachiopods of the Mississippian Banff Formation

Authors: Justice Kyeremeh and Muhammad Azlan

<u>Abstract</u>

Lower Carboniferous Brachiopods of the Mississippian Banff Formation Brachiopods are the most diverse organisms preserved in fossil assemblages of the Lower Carboniferous Mississippian Banff Formation of western Alberta. Previous studies report 87 species appointed to 53 genera. We have examined a collection from limestones of the Banff Formation in the Moose Mountain area. A total of nine orders have been reported from the Calvustrigis rutherfordi Zone. Of these orders, three dominate our samples: Spiriferida, Productida, and Athyridida. Each of these orders show their own evolutionary strategy to survive in the same demanding environment. More specifically, being filter feeders, these different evolutionary strategies (spine-bearing, and thick impunctate brachial and pedicle valves) maintained their sub-orthotetic or pleurothetic life habits. The Moose Mountain impunctate spiriferids as well as some crinoid calices occur predominantly in biomicrite, a type of limestone. We conclude the depositional environment of our Calvustrigis rutherfordi Zone samples, in the Mississippian Banff Formation was a carbonate ramp below normal wave base but above storm wave base. Occasional storms can account for the brachiopod shell lags evident in several of our samples. The lack of nonattached recliners, notably Strophomenida, in the assemblage is consistent with the inferred paleobathymetry. The fact that most of the brachiopod specimens are articulated indicates little reworking between storm events.

Keywords: Brachiopods, Mississippian, Banff Formation, Moose Mountain, Paleoecology

Supervisor: Paul Johnston

Poster #1515, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Non-Functional Morphology—Adaptive Significance of Bivalve Shell Features Reconsidered

Authors: Samantha Warren and Kelly Stasiuk

<u>Abstract</u>

Are all morphological features in bivalves functional? Two bivalve species from Plio-Pleistocene deposits in North Carolina were examined in this context. In particular, functionality or non-functionality of the lunule, escutcheon, radial ridge and troughs in these taxa were investigated. Both species have a prominent lunule, which in earlier studies, was hypothesized to aid in counteracting the recoil force of the bivalve burrowing. Despite Arcinella cortuna having a pronounced lunule, it is a non-burrower, which does not support this hypothesis. Rather than the lunule having an independent function, it is more likely a result of fabricational noise. This hypothesis extends to the escutcheon, which is an inevitable result of the growth of the posterior edge of the hinge plate and serves no demonstrable function. Radial ridges and troughs of Mercenaria corrugata and Arcinella cortuna appear to be a result from undulations of the mantle template at the shell margin. The resulting wavy commissure is primarily an anti-sea star defense. The adaptive significance of the radial structures that necessarily result is not obvious, especially in M. corrugata. However, the radial ridges in A. cortuna may be a beneficial anti-predatory side effect that is enhanced with the development of prominent spines. If the lunule and escutcheon are functional they must serve the same purpose in all bivalves. The life mode of M. corrugata is infaunal and A. cortuna is epifaunal. These variations strongly support the non-functionality of these features in both Pleistocene bivalves.

Keywords: Bivalve: Fabricational Noise: Functional Morphology: Mercenaria: Arcinella

Supervisor: Paul Johnston

Poster #1516, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Fossil Abundance and Diversity at the Trilobite Beds of Mount Stephen

Authors: Dylan Desjardins and Paul A. Johnston

<u>Abstract</u>

Investigation of bedding surfaces exposed on slabs collected from the Trilobite Beds, in the middle Cambrian Burgess Shale, Mount Stephen, revealed well-preserved assemblages of trilobites and other organisms. At least three facies can be recognized based on the colour of the deposits and assemblage composition: an overlying green facies, a middle red facies, and the underlying black facies. Morphological examination revealed six trilobite genera and species represented on the slabs: Ogygopsis klotzi, Olenoides serratus, Bathyuriscus rotundatus, Ptychoparella cordillerae, Zacanthoides romingeri, and Peronopsis montis. Key distinguishing features include: length of the trilobite from the cephalon to the pygidium; the number of pygidial segments; relative pygidial size; and whether peripheral spines are developed. Key findings include: 1) density of trilobites increases downsection, being highest in the black facies; 2) species diversity of trilobites increase upsection, being highest in the green facies; 3) juveniles were not recognized in any samples, indicating brooding occurred outside the outcrop area; 4) linguliformean brachiopods, common in the green and red facies, were not observed in the black facies.

The high density, low diversity black facies may indicate a stressed paleoenvironment, likely one closer to exhalative fluid sources on the seafloor, as proposed in earlier research. Facies showing decreased density but higher diversity likely represent environments more distal to fluid seeps and associated microbial productivity, as occurs around modern seeps and vents.

Keywords: trilobites; facies; density; diversity; genus

Supervisor: Paul Johnston

Poster #1517, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Sedimentary Mélanges and Low Grade Metamorphism on Coastal California

Authors: Alexandra Patterson

Abstract

The Franciscan Complex of coastal California provides a unique opportunity to study ophiolites, mélanges and metamorphism, which are features associated with subduction zones that are now exposed on the continent. Sedimentary mélange (or olistromes) are rock masses that contain exotic and native blocks within a deformed matrix which are thought to have formed during gravity sliding. Sample 2018K, from Goat Rock Beach, is composed of 30% Chert and 20% Mafic fragments, such fragments would classify the original sediment that formed this rock as a lithic arenite sandstone. The chert would have come from the top sedimentary layer, and the mafics from the basaltic pillows near the top of an ophiolite complex. Ophiolites are slices through ocean crust and the underlying mantle, that are now exposed on top of continental crust due to thrusting associated with subduction zones. Ophiolites that lack upper mantle rocks, such as the one at Goat Rock Beach, may represent obducted slices of seamounts or oceanic plateaus. Seamounts are submarine mountains, that are usually conical in shape and rise 1000 metres above the ocean floor. The mafic fragments in Sample 2018K now contain pumpellyite + epidote which represents greenschist metamorphism (300 to 450 °C, 1 to 4 kbars) typical of rocks that experienced metamorphism at depths between 8 and 25 km. Sample 2018T is a blueschist (200 to 500 oC, 4.5 to 14 kbars) which subduction down to 15 to 30 km. This shows the complexity and diversity of metamorphism that is preserved in mélange.

Keywords: low grade metamorphism; mélange; sedimentary; ophiolites;

Supervisor: Katherine Boggs

Poster #1518, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Mystery fossils of the Lower Cambrian Gog Group

Authors: Natasha Campbell and Conor Newton

<u>Abstract</u>

Bergaueria Prantl, 1945 is the plug-shaped resting trace of Cambrian-aged sea anemones. We examined several slabs of sandstone from the Lower Cambrian Gog Group, which were collected in southeastern British Columbia, and that feature abundant Bergaueria. We determined that these ichnofossils likely represent a monospecific population of anemones at various growth stages. To formulate this conclusion, the diameter of each trace was measured and plotted on a histogram to illustrate the frequency of the various growth stages within the population. Because our histogram produced a normal distribution, we concluded the monospecific population met its abrupt demise with its members at various growth stages. Earlier studies of the Lower Cambrian Gog Group near Lake Louise, AB indicate the deposits are associated with shallow marine, siliciclastic-dominated environments that formed along the margin of Laurentia. Our samples come from 10 km south of Lake Louise but were likely comparable depositionally. The preservation of our Bergaueria traces indicate the sand in-fill was deposited quickly, possibly while the organisms were present, or shortly after their demise. This quartz sand deposition is accompanied with imbricated clasts that probably were a result of a storm event or slumping sands down paleoslope. Because of the size of the imbricated clasts, we can infer that this population inhabited a proximal continental shelf environment that was close enough to shore to incorporate the clasts.

Keywords: Trace fossil; Lake Louise; Bergaueria; sea anemone; population structure

Supervisor: Paul Johnston

Poster #1519, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Eocene Ancestors of Botflies (Oestridae)

Authors: Jeffrey Yee and Samantha Mathews

Abstract

Located in southwestern Wyoming, eastern Utah, and western Colorado, the Eocene Green River Formation is known partly for its oil shale possibilities and partly for its impeccably detailed fish, insect and plant fossils. Earlier studies made passing mention that some of the insect fossils preserved in the formation are larvae of Lithohypoderma, a member of the Oestridae or botfly family. The Lithohypoderma hypothesis originates from a 1917 publication that claims the location of the larvae can be "easily explained" by hosts dropping larvae at the lake shores. This, however, does not address the question of how parasitic botfly larvae were preserved at the bottom of a deep water lake deposit without traces of a host. We examined a slab with the alleged botfly fossils and earlier literature and propose a scenario by which ancestral botflies could be preserved in the Eocene Green River Formation. The appearance and context of the Lithohypoderma fossils leads us to hypothesize that the fossils preserved in the slabs and in the literature are not parasitic at all; they are an early aquatic-larvae-bearing ancestor of modern botflies that had yet to adopt a parasitic life stage. The Eocene was a time of diversification for mammal groups, and we infer that the abundance of mammals would provide a selective advantage to the descendants of "Lithohypoderma" that parasize the abundant hosts, and that this is a possible origin of modern botflies.

Keywords: Lithohypoderma; parasitism; Eocene; Oestridae; larvae

Supervisor: Paul Johnston

Poster #1520, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Middle Cambrian calcium-rich oceans: A make it or break it time for life on Earth

Authors: Tara Berglund, Jenni Scott, Shaylin Sampson, Aryan Tyagi, Hector Munoz and Haley Leavitt

<u>Abstract</u>

We examined the middle Cambrian evolution of animals with calcareous skeletons, such as trilobites, and determined the most important conditions that led to the relatively rapid diversification event called the Cambrian Explosion. We investigated cycling between Earth's spheres in Series 2 and Series 3 of the Cambrian period (~521-497 million years ago) in order to understand the conditions that permitted life to thrive. Based on our research from published literature, we think that the most important factors that contributed to the multifariousness of life was the increasing oxygen and calcium levels in Earth's oceans. Life-forms like trilobites and other species began synthesizing calcium to form protective shells and skeletal structures. High levels of calcium in shells were an outcome of a low ratio of Ma2 + / Ca2 + in the oceans, resulting from mineral alteration in high-temperature oceanic crust, particularly near spreading zones. The shells of trilobites not only increased their protection but their mobility as well. Relatively high CO₂ (\sim 7000ppm) and increasing O₂ levels in the atmosphere also likely impacted the development of life as we know it but did not have as big of an effect as increasing calcium in the oceans. Sea-floor spreading influenced the composition of the shallow and deep oceans and affected all life forms that lived there. This time of increased diversity, brought upon by the rifting of oceanic crusts, can be compared to other diversification events like the evolution of new carbonate-producing marine organisms in the Triassic, when the Atlantic Ocean began to open.

Keywords: Cambrian Explosion, Trilobites, Geology, Evolution, Shells

Supervisor: Jenni Scott

Poster #1521, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Form and function of prosopon in Devonian Trilobites from Draa Valley, Morocco

Authors: Daniel Leboeuf, Taylor Brown and Megan Goulet

<u>Abstract</u>

Trilobites are extinct arthropods that are known to display a diverse array of prosopon (ornamentation) including spines, ridges, nodes, tubercles and pseudotubercles. Tubercles are nodal structures that have an opening through the exoskeleton and likely had sensory functions; pseudotubercles superficially mimic tubercles but without apparent sensory function. The function of these structures are often difficult to determine, even in modern arthropods. We examined 13 well preserved, articulated specimens and determined they are Order Protedia and Order Phacopida of the Devonian Period from Draa Valley, Western Anti-Atlas, Morocco. Our collection of trilobites are immaculately preserved and complete, displaying necrolytic postures, which implies rapid burial and minimal post-burial alteration. The enclosing sediments consist primarily of calcareous mudstones, which indicate a sub-tropical shallow marine environment. Ammonium chloride was applied to each specimen to enhance morphological characteristics for study and photography. We analysed the placement of tubercles and pseudotubercles along the exoskeletons. Several specimens displayed more numerous tubercles on the glabella, and the ratio of tubercles to pseudotubercles decreased along the axial lobe and pygidium. We conclude that the majority of tubercles are located on the glabella of these specimens to provide sensory functions for predation avoidance. Pseudotubercles are distributed on the glabella, axial lobe, and pygidium which likely made it more difficult for predators, such as cephalopods and placoderm fishes, to grip them.

Keywords: Trilobites; pseudotubercles; tubercles; Devonian; Morocco

Supervisor: Paul Johnston

Poster #1522, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Sustainable Reclamation: A toxicological comparison of bitumen-stained sandstones to tailings of an end pit lake

Authors: Ramon Vamenta

<u>Abstract</u>

End pit lakes (EPL) are currently being used for the reclamation of post-mining pits in the Athabasca Oil Sands. There is a debate whether EPLs can provide long-term sustainability for a biologically active ecosystem, considering the possible toxicological influence of added tailings underneath the capped water of the EPLs. X-Ray Diffraction (XRD) and X-Ray Fluorescence were used in this study to analyze bitumen-stained sandstone core and outcrop samples from the McMurray Formation. These methods characterize the geochemical characteristics of samples, and are compared with the composition of residual bitumen in tailings. The XRD results indicate that quartz, clays, and feldspars are the dominant minerals found in the samples. High amounts of sulfur and trace metals such as arsenic and lead are interpreted to be part of the bitumen component in the samples. The measured metals are primary agents for toxicity, all of which are constituents of bitumen in naturally occurring outcrop and core samples. In correlating these results to tailings in EPLs, it was determined through literary research that the metals

in residual bitumen contributed to nominal toxicity, most likely due to the lower weight per volume of bitumen in the EPL. Polycyclic aromatic hydrocarbons in bitumen may also add to the toxicity, however, recent published studies revealed that naphthenic acids are the most damaging constituent in tailings. Even at low concentrations, these acids can drastically increase the toxicity of an EPL, thus, its containment should be the focus for moving forward for the general acceptance of EPLs.

Keywords: toxicology; bitumen; McMurray; end pit lake; tailings; sandstone; metal; naphthenic acid

Supervisor: Jenni Scott

Poster #1523, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Mississippian Brachiopods and Peculiar Tube Structures of the Lead Cove Region, Newfoundland

Authors: Adam Gutsche

<u>Abstract</u>

Dense, monospecific brachiopod assemblages and strange tube-shaped structures occur in the Mississippian Big Cove Formation of the Codroy Group in the Lead Cove Region, Newfoundland, Canada. The formation consists mainly of biohermal limestone and sandy limestone breccia, sandstone and biostromal limestone with mounds. The brachiopod fossils exhibit the characteristic lamp shell shape, prominent pedicle foramen and punctate shells of the Order Terebratulida and are referred to the family Beecheriidae. The beecheriids nearly always are found articulated, without preferred orientation, well preserved, and in various shell sizes, which suggests that the arrangement reflects a mode of life rather than hydrodynamic deposition. The brachiopods are hosted in the biohermal limestone regions of the formation. Galena and marcasite deposits in the area indicate contemporaneous seafloor venting of metalrich fluids. The dense accumulations of in situ shells, exotic cements and regional geology indicate a chemosymbiotic mode of life of the Beecheriidae. The tube structures are thought to be either natural casts of siboglinid worms or marine vents resulting from the transportation of sulfur-rich gases through host sediments. Key pieces of evidence relevant to these interpretations include: the tube structures exhibit an outer rim of botryoidal aragonite and are filled with micrite and sparry calcite; fossil siboglinids in other regions are typically associated with brachiopods or molluscs; and, there is no obvious narrowing of the tube structures from infill of sediment over time. Overall, the evidence suggests the tube structures are likely natural casts of siboglinids rather than marine vents.

Keywords: Brachiopods; Siboglinids; Beecheriidae; Tube worms; Mississippian

Supervisor: Paul Johnston

Poster #1524, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Limpets Take a Bite Out of the Mosasaur Hypothesis

Authors: Wesley Barr and Paul Johnston

Abstract

The preservation of alleged predator-prey interactions during the Late Cretaceous between mosasaurs, a group of large marine reptiles, and Placenticeras ammonites, a genus of cephalopods with disk-shaped shells, is long celebrated as a combat drama preserved in the fossil record. Primary evidence for this are ammonites from the Upper Cretaceous Bearpaw Formation of south-eastern Alberta that show perforations thought to be caused by mosasaur bites. However, a second interpretation argues that the perforations are the result of diagenetic alteration of depressions created by limpets called home scars. Limpets are archaeogastropods that form oval-shaped resting depressions on hard substrates. Both limpets and their home scars have been found on these ammonites. This study adds to previous observations by comparing the shape of the perforations to mosasaur teeth and to Acmaea occidentalis, a species of limpet found on Placenticeras. Shape analysis was conducted using mosasaur tooth aspect ratios (crown height/transverse width), perforation morphology, and length and width measurements of perforations and A. occidentalis. Using t-tests it was shown that the perforations and A. occidentalis have very similar length/width ratios. Additionally, more than 50 perforated ammonites were examined to identify examples where perforations occurred near the shell perimeter. Of these, six examples showed holes that clearly required a corresponding exit hole on the obverse side if produced by a mosasaur tooth, but none were found. A further eight examples may have required exit holes depending on the specific aspect ratio of the puncturing tooth. These new observations support the home scar hypothesis.

Keywords: ammonites; mosasaurs; limpets; perforations; Cretaceous

Supervisor: Paul Johnston

Poster #1525, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Evidence for an ancient subduction zone in western California

Authors: Mathieu Boudreau

Abstract

The Franciscan Mélange/Complex of western California formed during subduction of the Farallon oceanic plate beneath the North American plate over a period of 150 million years (Ma; 165-12 Ma). An accretionary prism, a wedge-shaped body of sediments, formed due to material from the subducting oceanic plate being scrapped off and accreted to the associated continental margin of the convergent plate boundary. Sample 2018R is a greenstone nodule from a serpentinite matrix mélange in the Franciscan Complex. The term mélange is described as a body of internally disrupted and mixed rocks, generally found in a pervasively deformed matrix, which is considered to be evidence of a subduction zone. Sample 2018R primarily contains actinolite+ epidote+ chlorite which indicates that the nodule experienced greenschist metamorphic conditions (~300-450°C, ~0.2-0.8 GPa, suggesting formation at a depth of 10-20km). There is no developed foliation in the nodule, likely because deformation was accommodated by the softer serpentinite matrix that surrounded this nodule. Above the Franciscan mélange there is an associated ophiolite which is oceanic crustal and mantle material that has been abducted onto continental

crust during subduction. The source of the greenstone blocks may have been seamounts that were decapitated from oceanic crust during subduction, from the top of this ophiolite. The presence of mélange and ophiolite material such as sample 2018R provides evidence now at the surface for an ancient subduction zone.

Keywords: California, Franciscan Complex, mélange, ophiolite, greenstone, greenschist, metamorphic

Supervisor: Katherine Boggs

Poster #1526, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Californian Franciscan Complex Serpentanized Mélange Serpentine-Talc Nodule

Authors: Devin Recsky

Abstract

Mélange form at convergent plate boundaries due to offscraping and underplating particularly where there is a rapidly subducted plate as per the Californian Franciscan Complex where the Farallon Plate was subducted under North America. Sample 2018P is composed of serpentine + talc + magnetite. The lack of felsic minerals suggests that this sample was originally an ultramafic mantle peridotite composed of olivine and pyroxenes. The Earth's mantle is composed mostly of peridotites; which implies that Sample 2018P originated from the base of an ophiolite complex. Ophiolites are slices though oceanic crust and the upper mantle that have been thrust over continental crust. Ultramafic reaction curves are steep in pressure and temperature space, meaning that the formation of talc is useful for limiting metamorphic temperatures (i.e. at temperatures greater than 500°C; implying depths greater than 17 km) but not useful for constraining metamorphic pressures. Other mafic-composition mélange clasts are required to constrain pressures. For example samples 2018T and 2018X contain glaucophane + lawsonite which provides evidence for blueshist metamorphism (range of 200-500°C and 0.7-1.4GPa) providing evidence that this region in California was once subducted to a depth of 15-30 km before the ophiolites were thrust into their current position.

Keywords: Mélanges; Serpentanized; Serpentine-Talc Nodule; Californian Franciscan Complex; Ophiolites; Ultramafic; Blueshist

Supervisor: Katherine Boggs

Poster #1527, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Crawfordsville Crinoids: Identification and Interpretation

Authors: James Climie and Victoria Tenor

<u>Abstract</u>

Jim C. Climie, Victoria M. Tenor Abstract: Crinoids are benthic, sessile, suspension-feeding animals comprising the Class Crinoidea of the Phylum Echinodermata. This class includes both extant and extinct species, dating from the Ordovician to the present. The Edwardsville Formation located in Crawfordsville and Monroe counties of Indiana exhibits excellent preservation of shallow marine species from the Lower Mississippian Period, specifically the Osagean Stage. Composed of fine-grained siltstone and sandy shale of distal deltaic origin, fossil preservation in the Edwardsville Formation shows a high degree of fidelity. The Crawfordsville crinoid assemblages from this formation are the most famous examples of preservation of this group, yielding some 63 species in 42 genera. We have identified four genera from this unit in the Mount Royal University collection, namely Cyathocrinites, Poteriocrinites, Histocrinus, and Taxocrinus. Identification of each genus was made using morphological features of the stalk, crown, and dorsal cup. Cyathocrinites features thick brachia, branching a limited number of times, and a large well defined calyx. Poteriocrinites has poorly defined basal plates and a necrolytic pose of stretching its brachia straight out from the crown. Histocrinus exhibits straight brachia with pinnules and a small dorsal cup. Taxocrinus features straight, seldom-branching brachia that curled in after death. Many of these features allow inference of the paleoecological niches filled by these species. The length, number of branches, and presence of pinnules on the brachia influenced the tiering and quantity of food the crinoid could access, thereby filling different ecological niches.

Keywords: Crawfordsville; crinoid; morphology; preservation; Mississippian

Supervisor: Paul Johnston

Poster #1528, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Investigating the Nizi Deposit of Northern British Columbia: a mineralogical examination of a prospective economic molybdenum, copper, and gold deposit

Authors: Darby Desrosiers

Abstract

Porphyry deposits are largely responsible for economic minerals such as molybdenum, copper, and gold. These deposits are the source of 100% of molybdenum, 50% of copper and 10% of all gold produced in Canada. Porphyry deposits are located across Canada, but a large portion is concentrated along the west coast of British Columbia and in Yukon. The Nizi deposit of northern British Columbia is located 80 kilometres northeast of Dease Lake. Due to its remote location, little exploration or research has been done in on the deposit. To better understand the deposit, a petrological analysis was conducted on the samples from 1997 and this data is compared to previous work. By analyzing the mineralogy of the 1997 samples, a more detailed comparison of the Nizi vein system to a classic epithermal system was accomplished. From the results, it is concluded that this deposit signifies a late magmatic stage, low-sulphidation, type 2 epithermal system.

Keywords: Nizi; Porphyry; Epithermal Deposit; Gold Prospect Supervisor: Jeffrey Pollock

Poster #1529, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Ophiolite Metamorphism of Alpine Corsica

Authors: Shelby Austin-Fafard

<u>Abstract</u>

In Northern Corsica an ophiolite (Schistes Lustrs; oceanic crust with underlying mantle) was thrust westward onto the ancient continental basement (Hercynian (Paleozoic) crystalline basement). Sample 2018L, contains Cr-bearing pyroxene (Cr-diopside), suggesting that this sample was originally a mafic gabbro from the base of the crustal portion of the Schistes Lustrs ophiolite. Sample 2018L was so intensely altered during the closure of the Ligurian/Tethyan ocean during the Upper Cretaceous (66-100 Ma). During emplacement of the ophiolite most of the iron and magnesium was removed by fluids causing the rock to have a felsic appearance. Instead of mafic minerals typical of a gabbro, Sample 2018L now has sericite (35%), feldspar's (20%), and quartz (5%). Evidence of the Upper Miocene (5-11 Ma) tectonic extension at the end of the Alpine Orogeny is preserved by the retrograde (lower temperatures and pressures) metamorphism seen in Samples 2018V and 2018Y. These samples have early eclogite metamorphism (600-650OC and minimum of 1.5 Gpa) characteristic of the bottom of the crust (depths of more than 50 km), with later hydrated blueschist metamorphism (450-500oC and 0.5-0.7 GPa) typical of being subducted to greater than 45 km depths, followed by late greenschist metamorphism associated with this Upper Miocene tectonic extension. While Sample 2018L does not preserve evidence of these metamorphic conditions, it does provide evidence for the significant deformation, fluid flow and alteration that occurs when ophiolite are emplaced.

Keywords: Corsica; Metamorphism; Alteration; Cr-diopside; Gabbro; Ophiolite

Supervisor: Katherine Boggs

Poster #1530, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Phosphoria Formation, Possible Source Rock for Fracture Fill Hydrocarbons of the Green River Formation

Authors: Ngoc Nguyen and Jennifer Scott

<u>Abstract</u>

The Green River Formation represents an Eocene system of lacustrine deposits. A member of the Green River Formation at Wyoming, the Laney, contains hydrocarbon- infilled fractures of the Lower LaClede bed. The Meade Peak Member of the Permian Phosphoria Formation is a carbonaceous shale which may be the organic source rock for many overlying units, including the hydrocarbons in the Green River fracture fill. Based on Raman spectroscopy, hydrocarbon spectra of the Phosphoria Formation and Green River fracture fill can be identified in 2 main peaks: G peak (at around 1600 cm-1), D peak (at around 1340 cm-1). The intensity, ratio and interval of the G and D peaks can be used to interpret the maturation

of the hydrocarbons, and by extension to determine the similarity or difference between hydrocarbons of the two formations. The results show that the Phosphoria Formation has very similar Raman spectra to the Green River fracture fill. Comparing results from hydrocarbon spectra of the Green River fracture fills to the Phosphoria black shale shows similar intensity and G and D peak ratios. Further research can be done to clearly identify the chemical composition and the timing of migration of these hydrocarbons.

Keywords: fracture, hydrocarbon, source, rocks, raman, spectra

Supervisor: Jennifer Scott

Poster #1531, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Folded Eclogite and Blueschist of Alpine Corsica

Authors: Adam Gutsche

Abstract

Northeast Corsica is home to an Alpine Cenozoic aged (65 - 45 Ma) high-pressure terrane formed during subduction which involved the thrusting onto continental crust of an ophiolite (oceanic crust with underlying mantle). An ocean-continent transition is preserved in Corsica from the deformed Tenda Massif in the west to high pressure metamorphosed ophiolites in the northeast, implying that metamorphism also increases to the east. Sample 2018G, from the east coast of Cap Corse in northern Corsica, has folded bands of eclogite and glaucophane-lawsonite blueschist. The eclogite formed under temperatures of 400 - 600°C and pressures of 1.6 - 2.4 GPa, while the blueschist formed under temperatures of 350°C - 450°C and pressures between 0.8 - 1.2 GPa. This sample also contains felsic bands. The combination of these felsic bands and mafic eclogite/blueschist bands was interpreted to have originated from volcanogenic sediments of interlayered mafic and felsic volcanic ash and chert; representing the uppermost crustal portion of the Schistes Lustres Ophiolite sequence. Eclogite metamorphism implies that this samples was once at a depth in excess of 50 km; followed by the blueschist metamorphism associated with rapid subduction in a volatile-rich setting. Blueschist metamorphism is associated with subduction zones, such as the collision of the European and Adriatic plates during the Alpine Orogeny. Late greenschist alteration to chlorite occurred during the rapid low temperature exhumation of the late Alpine Orogeny, at rates up to 30 km/Ma.

Keywords: Metamorphism; Blueschist; Eclogite; Ophiolite; Corsica

Supervisor: Katherine Boggs

Poster #1532, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Potential Source Formations of Sulfate for the Paskapoo Aquifer of Alberta

Authors: Hugh Alvarez

Abstract

Groundwater in the Paskapoo aquifer has high levels of sulfate, above the World Health Organization limit in some areas, due to overlying glacial till. This makes groundwater in certain parts of Alberta unsafe for drinking unless treated. Although dangerous levels are associated with eastern Laurentide till, sulfate in Paskapoo groundwater with overlying western Cordilleran till is still relatively high. Research on which rock formations the till consists of is also limited. The focus of this study is to determine which formations have the potential to contribute sulfate to the Paskapoo aquifer as till components. Samples from each tested formation were analyzed with X-Ray Fluorescence to determine the quantity of elemental sulfur. Additional geochemical analysis was done on powdered samples to determine if the tested formations could provide sulfate. A map was also made using ArcMap software with spatial data of the Paskapoo and other sampled formations, along with the flow directions of the Laurentide and Cordilleran ice sheets. Those formations aligned with the Paskapoo sandstone and the flow direction of the ice sheets, in addition to having sufficient levels of sulfur/sulphate, were judged as potential candidates for contributing to the sulfate levels in the groundwater. Shales and carbonate deposits are often associated with high sulfur content, and are therefore likely suppliers, however flow patterns from the ice sheets may restrict formations from the Rocky Mountains as till.

Keywords: Paskapoo; Groundwater; Sulfate; Till; GIS

Supervisor: Jenni Scott

Poster #1533, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Significance of serpentinite in Coast Range ophiolite, California

Authors: Erik Guma

Abstract

California's Coast Range Ophiolite (CRO) provides excellent evidence for seafloor metamorphism, subduction tectonics and the formation of tectonic mélanges. Ophiolites are remnants of ancient oceanic crust and upper mantle emplaced into continental margins. Oceanic crust older than 170 million years has been subducted, hence ophiolites are the only way to study seafloor spreading older than 170 Ma. Sample 2018D is composed of 95% serpentine minerals (80% antigorite/lizardite, 15% chrysotile), 3% magnetite, and 2% relict pyroxene. The lack of felsic minerals and the high concentration of serpentine suggest that this sample was originally a peridotite which represents the bottom mantle component of the CRO. Serpentinization describes the process where ultramafic rocks undergo hydration (at T = 100-400°C) associated with seamount formation near divergent plate margins. Serpentinization plays an important role in the recycling of elements from the surface to the deep lithosphere and back to the surface. Tectonic mélange are large-scale breccias with a deformed matrix produced during the subduction process. By itself, sample 2018D does not constrain the metamorphic pressures experienced by the Coast Range Ophiolite because these reaction curves are steep in pressure-temperature graphs. Samples 2018K (Pumpellyite-epidote-greenschist; T = 250-500°C; P = 0-0.9 GPa) and 2018T (Epidote-

biotite-calcite-garnet-muscovite-glaucophane-blueschist; T = 100-500 °C; P = 0.6-1.8 GPa) are useful for constraining metamorphic pressures and depths of formation. This illustrates the need to examine multiple samples from complex tectonic settings to construct the complete tectonic history of regions such as California.

Keywords: serpentinite; serpentinization; ophiolite; mélange;

Supervisor: Katherine Boggs

Poster #1534, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Coastal plain sequence stratigraphy of the "Cathedral mud" horizon of the upper Dinosaur Park Formation, Dinosaur Provincial Park, Alberta

Authors: Adam MacInnis and Taia Wyenebrg-Henzler

Abstract

The Dinosaur Park Formation (DPF) is an Upper Cretaceous unit in southern Alberta that represents a coastal plain \sim 75 million years ago, renowned for its extreme abundance of vertebrate fossils and exceptional exposure. The palaeoenvironment represents a low-relief coastal plain with sediments being deposited during an overall transgression (rising sea level). The effect of sea-level cyclicity on the coastal plain environments was studied using field mapping, sequence stratigraphy, and facies analysis, with detailed sedimentology and spectral gamma ray readings from measured outcrop sections (i.e. K%, Th in ppm, and U in ppm). The focus of this study is on the "Cathedral mud" horizon, several metres below the distinctive Lethbridge coal zone (LCZ) because it appears to be an extensive bed that can be used as a stratigraphic marker across the region. We think that mud-dominated horizon represents a rise in sea level, manifest as an increase in the water table across the coastal plain, with trace-fossil-containing estuarine channel deposits. Relatively high amounts of uranium and thorium, and low amounts of potassium within the Cathedral mud help to mark these changes in the palaeoenvironment. These results and the extensive lateral continuity of the horizon as mapped in the field help to indicate the widespread impact of sea level change on the coastal plain. This horizon also correlates in time with turnover events in fossil dinosaur assemblages. As such, our analysis may have major implications for understanding the evolution of biota preserved within the upper Dinosaur Park Formation.

Keywords: Coastal Plain; Dinosaur Park Formation; Sequence Stratigraphy; Sedimentology

Supervisor: Jenni Scott

Poster #1535, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: The Search for Coalbed Methane in Southwest Alberta

Authors: Virginia Gold

Abstract

On the shores of the Jurassic epicontinental Western Interior Seaway during the Columbian Orogeny, the Mist Mountain Formation was deposited within fluvial-deltaic environments as a prograding clastic wedge with swamps forming along the coastline. Later orogenies matured, folded, segmented, faulted

and fractured the coal deposits leading to diverse ranks, thicknesses, and structures within the Mist Mountain coalbed. This study determined the Mist Mountain Formation coal maturity and composition in relation to the depositional and tectonic setting through hand sample, polished section, X-ray fluorescence (XRF) and Raman Spectroscopy analysis to determine coalbed methane (CBM) prospects. Historically known as a mining hazard, since 1989, CBM has been recognized as an unconventional gas with current production in Alberta centering on the Horseshoe Canyon. Little research has been conducted on the Mist Mountain Formation, one of the main coal deposits of the Front Range with ideal thickness, high vitrinite content and structural influence for CBM production and a history of CBM expulsion. The coalification process (the process by which organic material is buried, pressurized, and matured into coal) determines the coal rank, with higher maturity and rank leading larger volumes of CBM generated. Hand-sample and polished-section analysis denote the coal to be subbituminous to bituminous in nature determined by variations in colour and hardness. XRF, used to determine the coal ash content, has yielded coal/coal ash to be moderate, suggesting semi-bituminous coal. Current results indicate a potential for CBM capacity which holds significance for exploration and prospective economic use.

Keywords: Coalbed methane; Mist Mountain Formation;

Supervisor: Jenni Scott

Poster #1536, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Olistostrome as Related to Blueschist and Greenstone in the Franciscan Complex

Authors: Ania Moisi

<u>Abstract</u>

The Franciscan Complex of California contains excellent evidence of an ancestral subduction zone including ophiolite complexes and tectonic mélanges. A tectonic mélange is a block-in-matrix structure that was formed due to tectonic erosion, mechanical mixing, hydration and chemical alterations of rocks at a subducting plate margin. A sedimentary mélange has a "block-in-matrix" which has clasts with primary features surrounded by a deformed matrix. The 70% fragments (chert, metamorphic mafic, polycrystalline quartz and feldspars) in Sample 2018 suggest that this was a sedimentary mélange. Ophiolites are slices through ancient oceanic crust and upper mantle that were tectonically emplaced onto the continent. The cherty clasts in 2018H sample would have come from the sedimentary layer at the top of the Coast Range Ophiolite (CRO) while the mafic clasts would have come from the pillowed lava flows near the top of the complex. As is typical of tectonic mélange, the Franciscan Complex contains clasts with a range of metamorphic mineral assemblages. Samples 2018X and 2018T are well-foliated blueschist clasts (without the other clasts of Sample 2018 (yours); while samples 2018U and 2018B are serpentinized ultramafic rocks that represent the mantle peridotites from the base of the CRO.

Keywords: mélange; ophiolite; sedimentary; franciscan

Supervisor: Katherine Boggs

Poster #1537, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Potential for Diamonds in the Kootenay Arc-Southeastern British Columbia: Petrographic Analysis of Lamproitic Rocks from Salmo, BC

Authors: Kathryn Targett

<u>Abstract</u>

Lamproites are extrusive igneous rocks, which originate from great depths (>150km) concentrated along cratonic margins; specifically they are commonly found within continental intraplate settings. These rocks form due to multiple melting episodes associated with lithospheric mantle sources, prior to effusive eruptions-which bring lava up lamproite pipes-to Earth's surface; the majority of lamproite rocks have erupted within the last 1.4 Ga, with the vast majority erupting during the Cenozoic and thus are associated with relatively young volcanoplutionic complexes. Peralkaline ultrapotassic rocks are known for their potential to host diamond bearing xenoliths, which makes lamproites economically important. Generally, there is limited information regarding these rocks, as only 30-40 localities globally have been discovered. This study contributes to the limited information associated with lamporitic rocks and their presence in Canada. Samples collected from two localities south-east of Salmo, BC-within the Kootenay Arc region (Bunker Hill and the Jersey-Emerald mining district), as well as a sample from the Lake District, UK, are subjected to petrographic analysis, which allows for lamproite classification and mineral assemblage comparisons. Comparing mineral assemblages provides insight into the overall genesis and potential for diamond bearing xenoliths. Based on data collected, potential for diamondiferous lamproite pipes in the Salmo region is unlikely, however possible; this is due to the limited concentrations of indicator minerals such as garnet (minor), and richtertite, as well as the overall tectonic setting. Increasing the sample size and broadening the location of study may further contribute to the diamond potential in southeastern British Columbia.

Keywords: Lamproite; Diamondiferous; Salmo; Kootenay Arc

Supervisor: Jeffrey Pollock

Poster #1538, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Franciscan Complex Greenschist

Authors: Johnathan Hagerman

<u>Abstract</u>

The Franciscan preserves evidence of a complex subduction zone that formed on the coastline of California 165 to 12 million years ago as the Pacific Plate was being subducted under the North American plate. Mélanges, rocks that are composed of fragments of all sizes that are both exotic and native to the area, are typically associated with most subduction zones. Mélanges form by either an upward intrusion of a more buoyant material into or through the overlying rock, or when exotic blocks are incorporated by gravity sliding in a subduction zone. Rock 2018F contains 40% sedimentary fragments (quartz, feldspar, chert) and 60% greenschist metamorphosed mafic fragments (chlorite, actinolite, epidote). This combination of sedimentary and mafic fragments classifies Sample 2018F as an olistrome mélange. Greenschists form between 300 and 450°C, between 0.3-0.6GPa at depths between 12-20km. Sample 2018X from the same mélange contains glaucophane which provides evidence for blueschist

metamorphism which form between 100 and 475°C, between .55-1.6GPa at depths between 18-55km. Ophiolites are slices through oceanic crust and the top of the mantle that were thrust up over continental crust; which are frequently found near ancient subduction zones such as the Franciscan. The chert and mafic fragments in Sample 2018F likely originated from the top of the ophiolite complex. This variety of fragment rock types in addition to the variation in metamorphic minerals preserved in these fragments demonstrate the diversity of rocks found in mélange due to their complex tectonic origins.

Keywords: Geology; mélange; subduction

Supervisor: Katherine Boggs

Poster #1539, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Geochemistry and petrography of gold-quartz-tourmaline veins in Cenozoic rocks of the Kootenay Arc, Bunker Hill mine site, British Columbia

Authors: Leela Witvoet and Y.M. DeWolfe

Abstract

The relationship between tourmaline-rich rocks and gold deposits has been well studied with examples from Ethiopia, Brazil, Australia, Ireland, and South Africa. Rare earth elements (REE) in tourmaline record the fluid chemistry and physiochemical conditions of mineral formation and can be used as a potential pathfinder for hydrothermal vein-type gold mineralization. Gold-tourmaline-quartz veins are found at the Bunker Hill mine site within the Wallack Creek stock and the Bunker Hill sill. In this study we use petrography and detailed mineral chemistry to fingerprint the conditions of vein formation with implications for gold exploration. The Wallack Creek stock veins contain sillimanite, K-feldspar, quartz, muscovite, tourmaline, rutile, and opaque minerals. Veins within the Bunker Hill sill have two distinct mineral assemblages. One contains quartz, plagioclase, K-feldspar, and epidote. The other vein contains quartz, K-feldspar, epidote, and trace rutile. Electron microprobe analyses of tourmaline show varying proportions of TiO₂, CaO, FeO, MgO, and Na₂O from core to rim. There are strong negative correlations between Al_2O_3 and FeO as well as FeO and SiO₂. The REE content of the tournaline crystals is very low compared to chondritic abundances. Tourmaline displays light (L)REE-enriched to LREEdepleted patterns with negative to positive Eu anomalies and flat, near-chondritic heavy REE patterns. Detailed mineral chemistry of tourmaline from quartz veins of the Bunker Hill area display REE signatures that suggest a genetic relationship between the tourmaline and gold. This genetic correlation makes tourmaline an important tool for gold exploration, since gold is seldom present as visible gold.

Keywords: gold; tourmaline; ore deposits; mineralogy; geochemistry

Supervisor: Michelle DeWolfe

Poster #1540, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Calcsilicate sheath fold metamorphism in Corsica, France

Authors: Allyssa Preece

Abstract

The island of Corsica, in the Mediterranean, is an excellent location to study ophiolites. An ophiolite is a section through the oceanic crust and upper mantle, which usually form at mid ocean ridges and are thrust on top of continental crust. Northern Corsica contains an ocean-continent transition from the autochthonous European plate through a deformed continental margin to the Schistes Lustres (SL) ophiolite sequence. Sample 2018Q contains quartz (15%), muscovite (25%), calcite (65%), and rutile (5%) suggesting that it is a calcsilicate from the marine sediment at the top of the SL ophiolite. The abundance of enriched mantle peridotites and lack of sheeted dike complexes suggests that the SL ophiolite has young oceanic basin origins. The rocks in the area have undergone four generations of deformation which suggest a complex deformational history. The first deformation (D1) is simple shear in an E-W direction which caused a lineation of minerals, shown in Sample 2018Q as elongated quartz crystals. The second deformation (D2) is back thrusting of the northwest Cap Corse (i.e. the well-defined crenulation cleavage in Sample 2018Q). The third deformation (D3) usually overprints D1 and D2 as further folding. The fourth generation (D4) of deformation is a large N-S anticline in the SL unit. Sample 2018Q also contains a sheath fold which likely formed during D3 and D4. Sheath folds are non-cylindrical in shape, frequently associated with shear zones and are considered to indicate the high strain associated with the placement of an ophiolite complex such as the Schistes Lustres.

Keywords: Sheath fold; ophiolites; Schistes Lustres; calsilicate; Corsica

Supervisor: Katherine Boggs

Poster #1541, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Cretaceous Ammonites of Alberta

Authors: Taylor Wasuita and Dallan Beaudin

<u>Abstract</u>

The Bearpaw Formation is exposed in southern Alberta and was deposited during the Campanian age within the Western Interior Seaway. The Bearpaw Formation consists of bioturbated marine sediments such as mudstone and isolated units of siltstone and sandstone. This Bearpaw collection at Mount Royal University includes ammonite and ammonite heteromorphs, notably Baculites compressus var. robinsoni and Baculites reesider, and two species of Placenticeras, namely P. meeki and P. intercalare. The presence of Baculites compressus var. robinsoni and P. reesideri indicates the collection was derived from the Baculites compressus and Baculites cuneatus zones and is of Upper Campanian age. Distinguishing features of Baculites include orthocone-shaped shells that exhibit a streamlined shape. Baculites species can be distinguished by the size and length of the body chamber and by the ventral ribs located on the shell. Baculites is of interest paleoecologically because adults and juveniles of some species are thought to have lived at different depths throughout the water column. Most Baculites species preferred well-oxygenated water and tended to occupy the middle of the water column. By contrast, Placenticeras species may represent different genders and are differentiated by the positioning of the aperture,

tubercles and size. The Placenticeras shell is planispiral and streamlined and this is interpreted to be a result of their predatory lifestyle throughout any depth in the water column.

Keywords: Bearpaw Formation; Baculites; Placenticeras; Campanian; Paleoecology

Supervisor: Paul Johnston

Poster #1542, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Abstract

Authors: Nkenjika Ngini

<u>Abstract</u>

The northern tip of Corsica in the Mediterranean, provides excellent exposure of mantle rocks, which would be 40 km beneath our feet in Calgary. This is because slices of oceanic crust with underlying mantle were thrust over continental crust to form ophiolites during the Alpine Orogeny (mountain The sample collected from the northern most tip is a banded serpentinized peridotite building). (originally olivine + pyroxenes with no felsic minerals), typical of ultramafic mantle rocks from the bottom of ophiolite complexes. Serpentinization occurs due to seafloor metamorphic processes, so this sample represents the base of the oceanic component of the exposed ocean-continent transition that is exposed across northern Corsica due to the Alpine Orogeny. The serpentinization process has gained interest recently because the hydrogen gas released during these reactions may help to explain the origin of life during the early history of the Earth. Serpentine first forms at temperatures above 250°C, typical of depths below 9km. These reactions are steep in pressure-temperature space and therefor do not constrain the pressure of metamorphism. Serpentinite dehydrates at temperatures above 700°C, these released fluids could possibly be triggering earthquakes. Other mafic samples such as 2018G and 2018Y preserve evidence of blueschist (100oC to 500oC and 0.6 to 1.6 GPa, suggesting depths of greater than 20km) and eclogite (600oC to 1000oC and 1.3 to 1.6 GPa, suggesting depths of greater than 50km). Such mafic composition is required to constrain pressures and depths of subduction because serpentinized samples do not constrain pressure.

Keywords: Serpentinization; Ophilite sequence; Metamorphic facies; Mantle rock.

Supervisor: Katherine Boggs

Poster #1543, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: From the Mantle to the Mountains

Authors: Evan Matthews

<u>Abstract</u>

Benitoite is a rare blue barium titanium silicate mineral, found in hydrothermally altered serpentinite from the Benitoite Mine in the Klamath Mountains of Northwestern California and is the state gem of California. Sample 2018U collected from this mine contained natrolite (Na2Al2Si3O10·2H2O) neptunite (KNa2Li(Fe2+,Mn2+)2Ti2Si8O24), and benitoite in veins through a serpentine matrix. This rare assemblage of sodium rich minerals indicate the presence of sodium rich fluid movement along

fractures after serpentinization. The complete serpentinization with a lack of felsic minerals (i.e. quartz or feldspars) indicates that this rock was originally a peridotite, the basal ultramafic layer of an ophiolite. Ophiolites are suites of temporally and spatially associated ultramafic, mafic, and felsic rocks that are interpreted to be remnants of ancient oceanic crust and upper mantle. The sodium bearing minerals along the veins in sample 2018U likely formed as the ophiolite was emplaced onto the continent as the ancient Farallon plate and collided with the North American plate between 260 and about 130 million years ago. Samples 2018P, 2018B, and 2018M are completely serpentinized from the Franciscan Complex of California lacking sodium bearing minerals; these are more typical of the basal mantle layer of ophiolites.

Keywords: Geology; Minerals; Metamorphism; Serpentinization; Hydrothermal; California

Supervisor: Katherine Boggs

Poster #1544, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Subduction Zone Serpentinite of Western California

Authors: Riley Medd

<u>Abstract</u>

The Franciscan Complex in California has a very complex geologic history involving the formation of ophiolites and tectonic mélange during the subduction of the Farallon Plate under North America nearly 200 million years ago. Ophiolites are sections through oceanic crust down into the upper mantle that are visible today because they were thrust upon continental crust. Tectonic mélange are chaotic rock units that are associated with subduction zones. There are two main types of mélange, serpentinites of ultramafic origin and mélange of sedimentary origin. Sample 2018B is a serpentinized clast from a mélange with ~90% serpentine, 5% magnetite and 5% rutile. The significant amount of serpentine within this sample provides evidence for seafloor metamorphism, and the presence of a serpentinized mélange. The lack of felsic minerals suggests an ultramafic protolith from the mantle-sourced basal unit of an ophiolite. Olivine and pyroxene become serpentinized when exposed to hydrous conditions below 500°C however, the reaction curves in P-T space are too steep to be useful for constraining pressures. Samples 2018T and 2018X consist largely of muscovite (~30-40%) and glaucophane (~40-50%), which provides evidence for blueschist metamorphism. Blueschist metamorphism occurs between temperatures of ~100°C and 500°C, at pressures between 0.7 GPa and 1.6 GPa, and is associated with deep subduction zones ranging from ~20km to 55km in depth.

Keywords: California; geology; subduction; ophiolite; mélange

Supervisor: Katherine Boggs

Poster #1545, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: The History of The Franciscan Complex and the Importance of Mélanges

Authors: Alexander Burn

<u>Abstract</u>

Mélangs occur in accretionary and collisional orogenic belts across the globe, and are the products of disrupted sedimentary, magmatic and metamorphic rocks in subduction settings. Mélanges are cogenetic with the deposition of ophiolites. Ophiolites are pieces of oceanic plates that have been thrust onto the continental crust. The Franciscan Complex of California records over 150 million years of continuous eastwards dipping subduction from (165 to 25 million years ago) of the Farallon Plate under North America. This subduction produced mélanges; both sedimentary and serpentinized. Sedimentary mélanges are produced by altered oceanic crust material and continental slope sediments in a sheared matrix. Serpentinized mélanges are produced by oceanic crust material and ductile flow of a deformable or water charged matrix. Sample 2018W is an olistrome fragment from a mélanges with 35% sedimentary fragments (quartz, albite and chert) and 65% mafic fragments with greenschist metamorphic minerals (actinolite, chlorite, epidote and titanite). Greenschist metamorphism occurs at temperatures of 300-450 °C and pressures of 0.3-0.6 GPa, representing depths between 8-35 km. Sample 2018X is close to Sample 2018W; it contains glaucophane which formed due to blueschist metamorphism. Blueschist metamorphism occurs in temperatures of 100-500 °C, pressures greater than 0.6 GPa and with depths greater than 20 km. Samples 2018X and 2018W represent the diversity of fragments found in mélanges while mélanges themselves record the tectonic history of settings such as the Franciscan Complex of California.

Keywords: mélanges;metamorphism;subduction;olistrome

Supervisor: Katherine Boggs

Poster #1546, Presentation Time: 10:00 am - 12:00 pm

Abstract title: How did high levels of carbon dioxide change Cretaceous climate and life during the 10-million-year period from the Cenomanian–Turonian at ~100 million years ago?

Authors: Brayden Thorogood, Andrew Boudjaklian, Braden Armstrong, Thomas Wooff and Naomi Attrill

Abstract

Brayden Thorogood, Thomas Wooff, Naomi Attrill, Braden Armstrong, Andrew Boudjalkian, Jenni Scott How did the carbon spike that occurred at the Cenomanian-Turonian (~ 94 Ma) boundary affect the Earth and all its spheres? Carbon dioxide in the atmosphere steadily increased from the beginning of the Cretaceous period right until the end of the Cenomanian where it reached the highest level since the Permian. Based on our research from published literature, we have determined that this was most likely caused by intense volcanism along mid-ocean ridges and in many volcanic provinces throughout Asia, which released vast amounts of carbon dioxide into the atmosphere from the geosphere. The large-scale volcanism and great outgassing of carbon dioxide also may have caused the widespread ocean anoxic events at this time and contributed to the sea level rise. Sea level was at its highest level since the Devonian

period. High volcanic activity and extensive seafloor spreading increased crustal production, which may have indirectly caused an increase in atmospheric carbon dioxide as well as high sea level. The high levels of atmospheric carbon dioxide may have led to increased plant biomass during the Cretaceous and contributed to the radiation of angiosperms and the first rainforest-like environments. The contemporaneous oceanic anoxic event also led to the extinction of 27% of marine invertebrates at ~93 Ma. Through this example, one can see how increased levels of carbon dioxide in the atmosphere are a result of processes operating in all of Earth's spheres, on long-term and short-term scales.

Keywords: Cretaceous; Volcanic; carbon dioxide

Supervisor: Jenni Scott

Poster #1547, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Serpentines is Corsica

Authors: Robert Blyth

Abstract

Corsica features a fascinating and complex geologic history starting with the ancient Tethys Ocean and ending with today's European Alps. Ophiolites, slices through oceanic crust, were thrust onto Cap Corse in northern Corsica. Sample 2018S is composed primarily of serpentine, a metamorphosed ultramafic from the mantle. There are two main tectonic settings in Corsica, Alpine Corsica and Variscan Corsica. The sample studied in this paper belongs to the former. The ultramafic protolith of the sample was an ophiolite which originated from the Ligurian Tethys basin. Mantle material partially melted producing a magma which subsequently crystallized into the ophiolites seen in Corsica. Obduction, the process by which one plate gets thrust on top of another subducting plate, brought the ophiolites to the surface. Subsequent metamorphism serpentinized the rock. Serpentinization occurs through heating and hydration of existing ultramafic rocks. Metamorphism ranges from blueschist up to eclogite conditions with pressure/temperature conditions from 6.7 to 8.6 kb and 360°C to 425°C. The result of the metamorphism is a foliated chlorite-actinolite-titanite serpentinite. Weathering of the serpentine creates iron-oxide staining, giving the rock a mix of colours from dark green serpentine on the fresh surfaces to dark brown on the weathered surfaces.

Keywords: Geology; Corsica; Obduction; Metamorphic

Supervisor: Katherine Boggs

Poster #1548, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Petrogenesis and tectonic seting of the Paleoproterozoic Kangilleq Formation of west Greenland and its correlation to the Bravo Lake Formation of Nunavut, Canada

Authors: Candace Toner

Abstract

The Paleoproterozoic Karrat Group is a metamorphosed, siliciclastic-carbonate-volcanic sequence of rocks in west Greenland. It is separated into north and south regions by the Prøven Intrusive Complex (PIC). The Kangilleq Formation is the only volcanic member within the group and is predominantly submarine basalts. The Bravo Lake Formation (BLF), found within the Piling Group of Nunavut, is a similar basaltic sequence with respect to lithofacies, lithogeochemistry and age. It is interpreted to have been erupted in a within plate setting. This study uses lithogeochemistry and Nd isotopes from the Kangilleq Formation to elucidate its petrogenesis and tectonic setting, and to make a correlation with the BLF. Based on lithogeochemistry and isotope data the Kangilleq Formation south of the PIC comprises alkaline basalt interpreted to have been erupted in a within plate tectonic setting, and subalkaline basalt interpreted to have been erupted in backarc basin. North of the PIC the formation comprises subalkaline basaltic andesite interpreted to have been erupted in an island arc setting. Because the Kangilleq Formation north of the PIC has geochemical characteristics indicative of eruption within a volcanic arc setting it is unrelated to the Kangilleq Formation south of the PIC, or the BLF. However, geochemical evidence and age constraints support correlation in tectonic and magmatic origin between the Kangilleq Formation, south of the PIC and the BLF. This new information will allow for correlation of the volcanic rocks, and bounding formations, across the Davis Strait with important implications for plate tectonic reconstruction and mineral exploration.

Keywords: radiogenic isotopes; lithogeochemistry; volcanic rocks; plate tectonics

Supervisor: Michelle DeWolfe

Poster #1549, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Trace Fossils of the Gog Group—Smoke from the Cambrian Explosion

Authors: Ryley Penner and Devon Brown

<u>Abstract</u>

The lower Cambrian Gog Group of southeastern British Columbia, Canada yields a diverse assemblage of trace fossils. The traces preserved reveal complex modes of behaviour and activity in arthropods during the early stages of the Cambrian Explosion. Major ichnogenera observed include Dimorphicnus (tool marks or scratches), Cruziana (feeding), Rusophycus (resting), and Diplichnites (trackways). The inferred presence of algal mats informs the paleoecology and provides a motive for grazing-style burrowing. In this study, phases and depths of substrate penetration were considered while characterizing the geometry and size of the burrowing traces. Varying depths of burrows on the bedding plane suggest the traces may represent different modes of behaviour or possibly undertracks of traces made on overlying bedding planes. The overall assemblage is consistent with the Cruziana ichnofacies. These traces indicate a depositional environment below fair weather wave base and above storm level wave

base. Evidence for storm event deposition from surrounding sediment provides an explanation for some of the different traces present, the behaviours that caused them, and the style of preservation. This ichnofacies in the Gog Group is dominated by arthropods that were most likely trilobites as evident from tool marks of biramous appendages. The direction of movement as inferred from the geometry and shape of the Cruziana burrows is also indicative of trilobites. At least two arthropod species are hypothesized to have produced the Cruziana and Rusophycus traces as indicated by the bimodal distribution of measured trace widths.

Keywords: Fossils; Traces; Cambrian: Cruziana

Supervisor: Paul Johnston

Mathematics & Statistics

Poster #1600, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Mathematical Modelling of a Measles Outbreak in Pre-vaccine England and Wales

Authors: Michael Wendlandt, Loren Cobb and Murdoch McKinnon

Abstract

We present a spatial variant of the time series susceptible-infectious-recovered (TSIR) stochastic population-based model to capture the spatial transmission dynamics of a measles outbreak across the landscape of England and Wales during the pre-vaccine era. Specifically, we explore how the basic dynamical features of a measles outbreak with a seasonal forcing of transmission acts as a major driver of a long-term epidemic behavior. We use a 20-year pre-vaccination era biweekly time series data (births by year and incidence of measles for the years 1944-1966) from 60 towns and cities in England and Wales to capture the spatial spread of measles. In England and Wales prior to vaccination, measles was endemic in large cities, but in smaller cities disease fadeout occurred. Reappearance of the disease would then occur only after a case was imported from a surrounding city where measles was endemic. To capture spatio-temporal dynamics, multi-city models must be developed, but these models can become very large requiring more memory and processing power than a single computer can deliver. Rather than represent the population as a linked set of cities, we represent the population as a gridded map. Each grid cell can transmit infectious disease to its neighbors, with probabilities that decline exponentially with distance. We present a stochastic spatial model with six compartments. We call this the kids-susceptibleinfectious-recovered-adults-dead (KSIRAD) model. From the simulation, we recover spatiotemporal maps of the incidence of the infection. We compare simulated time-series graphs with real data compiled by Grenfell and others.

Keywords: Mathematical Modelling, Epidemiology, Measles, R- Programming, Statistics

Supervisor: Ashok Krishnamurthy

Physics

Poster #1700, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Implementation of Quantum Logic Gates Using Linear Optics

Authors: Adam Gutsche

<u>Abstract</u>

Quantum computing is an area of ongoing study that is relatively new. Theoretical frameworks were developed as early as the mid 1970s, but physical implementations of quantum computers were not developed until the late 1990s. For a quantum computer to be functional the following are required: creation of qubits, implementation of quantum logic gates and detection of the qubits. Using linear optics, this experiment highlights the requirements for a quantum computer. A qubit was created by passing a single photon through a 50/50 cube beam splitter. A single photon source was simulated with a laser beam going through successive neutral density filters, reducing the light intensity such that a single photon is present in the system at any time. Two logic gates, a Pauli-X and a Hadamard gate, were implemented using two plate beam splitters and were tested separately. A Pauli-X gate works as a NOT gate, switching the qubit's states, and the Hadamard gate creates a superposition of states. The qubits were detected after passing through the logic gates using two Canon cameras with no lenses attached and set to long exposures. The long exposures were used to detect the presence of the single photons. Additionally, to be able to measure the results of the Hadamard gate, a second Hadamard gate was implemented before detection. The results show that both gates apply the correct logical operations on the qubits, but some error correction is required.

Keywords: Quantum Computing; Quantum Logic Gates; Linear Optics; Hadamard Gate; Pauli-X Gate

Supervisor: Alexis Morris

Poster #1701, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Understanding the human cardiovascular system from a biophysical perspective using a mechanical simulator

Authors: Jan Elaine Soriano

Abstract

The human cardiovascular (CV) system is a complex system comprised of the four-chambered heart acting as a pump, and an intricate network of branching blood vessels arranged in parallel with variable resistance. From a biophysical perspective, the building of a mechanical simulation of the human cardiovascular system requires consideration of the Frank-Starling mechanism, the Windkessel effect, volumetric flow, resistance to flow, cardiac and vascular pressures and mechanical properties of the blood vessels, which are crucial in understanding the hemodynamic behaviour of the CV system. For this project, we adapted a mechanical simulation of the CV system comprised of a PVC cylinder, rubber chamber and a pumping syringe to simulate the atrium, venous reservoir and ventricular pump, respectively. The materials and measurements were adapted from a previously designed model used for

the purpose of teaching. Moreover, the design of the model allows for modifications in the structures to simulate CV pathologies (e.g., atherosclerotic aortic disease). This model could be used as a teaching tool in biophysics and physiology courses, and as research tool to study the biophysical mechanisms involved in the healthy CV system and in the context of cardiac pathologies.

Keywords: cardiovascular system; Frank-Starling mechanism; resistance

Supervisor: Manuel Diaz-Avila

Scholarship of Teaching and Learning & Outreach

Poster #1800, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Emergence of Different Perspectives of Success in Collaborative Learning

Authors: Sarina Falcione and Ellie Campbell

<u>Abstract</u>

Collaborative learning, cooperative learning, and problem-based learning share a set of attributes, such as "mutually helpful behavior among students as they strive together to accomplish the learning task" (Davidson and Major, 2014). The distinguishing feature of collaborative learning is that students weave together self-driven (asynchronous) and group-based (synchronous) learning through active approaches (Smith and MacGregor, 1992). To support student learning, faculty have increasingly designed collaborative learning experiences for a variety of populations and environments, using an assortment of instructional styles. However, not all collaborative learning experiences are equally successful. As an international team of undergraduate students and faculty that have all engaged in collaborative learning, we asked the research question "what characteristics make collaborative learning successful?" Engaging in detailed self-reflection on past collaborative learning activities, and using thematic analysis, we identified five themes associated with successful collaborative learning: 1) familiarity with collaborative learning, 2) relationships, 3) benefits, 4) motivations, and 5) design and process. Furthermore, using a phenomenographic framework for qualitative analysis, we report how variations in prior experience influence individual descriptions of successful collaborative learning.

Keywords: Active learning, collaborative learning, education, phenomenography, success, SoTL

Supervisor: Brett McCollum

Wildlife Behavior, Conservation & Ecology

Poster #1900, Presentation Time: 10:00 am - 12:00 pm

Abstract title: There's something fishy about the seafood market

Authors: Catharine Tucker, Mitchell Cornell, Breanne Marois, Curtis Klemmensen, Carolyn Ly and Alyce Straub

Abstract

Seafood fraud is a growing concern because seafood products are frequently mislabelled and misrepresented across the globe. Recent studies revealed high rates of fish mislabelling in markets. Here we investigated seafood labelling accuracy in supermarkets and restaurants located within Calgary to compare mislabelling rates to other areas. DNA barcoding uses a short genetic sequence from a standard part of an organisms' genome to identify it as a particular species. It is a useful tool for taxonomic identifications from tissue samples without knowing geographical, morphological, or ecological information. Fish tissue samples (n = 10) were collected from supermarkets and restaurants in Calgary using LifeScanner species identification kits. From each sample, the 5' end of the Cytochrome Oxidase I mitochondrial gene was sequenced by LifeScanner at the Centre for Biodiversity Genomics in Guelph. From the 10 samples sequenced, 2 were found to be mislabelled. This result was consistent with other studies done in North America that found 23-25% of fish to be misrepresented in the market. The species of fish mislabelled involved fish that are of conservation concern. Seafood mislabelling raises concern for individuals who purchase their seafood with the species conservation status in mind and those who have food toxicity apprehensions. Farmed fish are easier to harvest and typically have higher levels of contaminants and toxicity so individuals avoiding consumption of species that are commonly farmed can encounter unwanted health problems. Despite the attention seafood misrepresentation is getting and the readily available species identification kits, seafood mislabelling continues to be prevalent.

Keywords: Seafood; Mislabeling; DNA barcoding; Genome; Conservation; Misrepresentation

Supervisor: Jonathan Mee

Poster #1901, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Attraction of Black-billed Magpies to bright versus dull objects

Authors: Toni Vandenbrink

<u>Abstract</u>

Urbanization has presented wildlife, such as Black-billed Magpies (Pica pica), with exposure to many manmade objects and food sources. Previous research has found magpies display a fear towards new objects; however, a different study proposed that in urban areas, corvids (relatives of magpies) displayed less fear of litter. This project sought to address a preconceived notion that magpies are attracted to shiny objects. This experiment consisted of exposing magpies to dull and sparkly objects and recording select behaviours that magpies displayed towards each. This experiment found evidence that magpies are not attracted to shiny objects, and in fact, neophobia towards the shiny object was observed. Future experiments could determine if olfactory cues or visual cues dominate a magpies interpretation of foreign objects. This could help determine the mechanism that plays a part in magpie behaviour.

Keywords: Biology, Magpies, Animal Behaviour

Supervisor: Melanie Rathburn

Poster #1902, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Stress behaviours associated with weaning quarter horse foals

Authors: Candace Ferguson

<u>Abstract</u>

Weaning is a stressful event for both mares and foals. There are many methods that a person could use to wean foals but there is no established best practice within the horse industry. Stress during weaning can possibly predispose foals to disease, injury, and a reduction in growth rate during their first year. For this study, I observed the behaviours of 8 foals ranging in age from 20-25 weeks to determine if there is an optimum age to wean foals. I hypothesized that older foals would display less stress behaviors than the younger foals. Focal animal sampling methods were used to collect behavioural data. The specific behaviors recorded included: time spent eating, time spent pacing, kicking, biting, ears pinned back, calling out, and trying to nurse on others. There were no correlations between the age of the foals and different stress behaviours. Parental care before weaning and imprinting of the foals could have a greater influence on the stress behaviours compared to the age of foals at weaning.

Keywords: weaning; stress behaviours; focal animal sampling; foals

Supervisor: Melanie Rathburn

Poster #1903, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: To cross or not to cross? Pedestrian risk taking behaviour not influenced by weather conditions

Authors: Carolyn Ly

<u>Abstract</u>

Animals encounter daily situations where energy constraints need to be considered and often involve a tradeoff where energy is decreased in order to increase the likelihood of survival. Energy constraints and tradeoffs can contribute to risk taking behaviour. In humans, risk taking behaviour is often observed when crossing the street. Pedestrians can ignore traffic laws and cross during a red light (and risk injury) or they can comply and cross during the appropriate crossing phase (and risk losing time). This study analyzed the effect of weather conditions on risk taking behaviour in pedestrians (n=72) who crossed along the intersection of Richardson Way SW and Richardson Link SW in Calgary, Alberta. Using focal animal sampling and frequency count techniques, pedestrian characteristics and behaviours were observed and recorded over six trials. Although the results suggest that inclement weather is not an accurate predictor of risk taking behaviour, an average of 60% of pedestrians did cross on a red light, indicating that other factors may have influenced crossing behaviour. There is ongoing and global interest in determining these factors as they can influence road design and development, traffic signal features, and potentially reduce the amount of pedestrian-vehicle collisions.

Keywords: animal behaviour, risk taking behaviour, pedestrians

Supervisor: Melanie Rathburn