Program & Abstracts

MOUNT ROYAL UNIVERSITY
1910

6th Annual Research Day

March 27, 2019 Ross Glenn Hall

Faculty of Science and Technology

Message from the Research Day Committee,

Welcome to the MRU 2019 Faculty of Science and Technology Research Day! We are pleased to present this compilation of the abstracts of students' research projects, presented as posters at the sixth 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 82 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!

As last year, we are scheduling our keynote public lecture on the same day as the Research Day – **March 27 at 12:30**. We are honoured and delighted to host Dr. Firouz Naderi, former director for solar system exploration at NASA's jet propulsion laboratory. Dr. Naderi's talk is titled "How Did We Arrive on Planet Earth; and Where to Next?"

We also would like to thank our sponsors Chemistry Matters Inc., Thermo Fisher Scientific, VWR International, Resverlogix, Pearson Canada, Oxford University Press, and MRU Institute for Environmental Sustainability for their generous support. We also would like to acknowledge the support from the Office of the Provost and Vice-President Academic for supporting the keynote lecture. This volume would not be complete without thanking our Dean, Jonathan Withey, for his unwavering support and ideas, Faculty of Science staff Barb Lindsay, Raghed Mirza, and Carla Slavik for helping in many different ways, Brian Sevick and Julie Brookson from Earth & Environmental Sciences for supporting poster printing and Steve Sutcliff from Information Technologies for facilitating the online platform for abstract and poster submission. 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

David Bird, Associate Dean (Research)
Trevor Day, Biology
Paul Johnston, Earth and Environmental Sciences
Barb Lindsay, Administrative support
Jonathan Mee, Biology
Raghed Mirza, Administrative support
Alexis Morris, Chemistry and Physics
Gwen O'Sullivan, Earth and Environmental Sciences
Mariya Svishchuk. Mathematics and Computing
Mathew Swallow, Earth and Environmental Sciences
Qasim Syed, Chemistry and Physics, (past Chair)

Sponsors

We are grateful to our sponsors who helped to make our event a possibility:

Chemistry Matters Inc.
Oxford University Press
Pearson
Resverlogix
Thermo Fisher Scientific
VWR International
MRU Institute of Environmental Sustainability

Invited Speaker
How Did We Arrive on Planet Earth; and Where to Next?
Presented by Dr. Firouz Naderi

March 27, 2019
Presentation: 12:30 p.m. Ross Glenn Hall (EC Building)

Dr. Naderi is the former Director for Solar System Exploration at NASA's Jet Propulsion Laboratory where he spent more than 30 years in various technical and senior executive positions. Best known for his leadership of the Mars exploration program, he has contributed to some of the most iconic NASA robotic missions to various corners of solar system. Dr. Naderi, who received his Ph.D. from University of Southern California, is a "Fellow" of the American Institute of Aeronautic and Astronautic (AIAA). He has been honored multiple times including the Ellis Island Medal of Honor, Technology Hall Fame Medal, NASA's outstanding leadership medal as well as NASA's highest award – the Distinguished Service medal. In March 2016, for his career contributions to space science and exploration asteroid "1989 EL1" was renamed asteroid "Naderi 5115".

Dr. Naderi has taught modules in executive education classes at Stanford on "Management of Large Complex Programs". He currently serves as an advisor to startup companies and is frequently invited as keynote & motivational speaker at conferences and workshops. He has given talks to student associations in universities including Oxford, Stanford, Berkeley, MIT, UCLA, USC, Duke University, University of Toronto and others on *wonders of exploration*.

Poster Sessions – Ross Glenn Hall

Morning Session (10:00 AM - 12:00 PM)			
Poster		**Title**	**Author(s); Affiliation**
Cell & Organismal Biology			
1000		The Effects of Relative Acute Hyperglycemia on Cardiac Autonomic Balance Between Sexes	Alexandra Skalk, Gary Saran, Zahrah Rampuri, Jan Elaine Soriano, Jeena Lorida, Tysen Joki, Sarah Hewitt, Trevor Day; Biology
1001		Cancer Stem Cell: The Fallen Angel	Sarina Falcione; Biology
1002		Can urine pH measures be utilized to assess the renal acid-base responses during high altitude ascent?	Brandon Pentz, Trevor Day, Mingma Sherpa, Tom Brutsaert, Nathan Ackroyd, John Chik, Emily De Freitas, Emily Vanden Berg, Rupinder Sandhu, Cassandra Nysten and Jordan Bird; Chemistry and Physics
1004		Effects of CO_2 on Regional Cerebral Blood Flow Regulation During Lower-Body Negative Pressure	Scott Thrall, Trevor Day, Rachelle Brandt, Kristi Wynnyk and Chantelle Green; Biology
1006		RNA-seq detection of PD-L1 in lung Cancer and potential clinical applications.	Reid McNei; Biology
1008		The Effects of Acute Hyperglycemia on Central Respiratory Chemoreflex Magnitude	Jordan Bird, Trevor Day, Nick Strzalkowski, Scott Thrall and Alexandra Skalk; Biology
1010		Characterizing Pectic Cell Wall Epitopes in the Argenteum mutant of Pea (Pisum sativum).	Damian La Rosa Montes; Biology
1012		The Impact of Five Amino Acid Characteristics on the Fluorescent Properties of Citrine	Breanne Bali, Savahnna Wolfe, Maddie Stewart, Reid McNeil, Mohamed Haymour and Reid Andersen; Biology
1014		Embryonic and Adult Stem Cells: Fraternal Twins that are Close, but Different	Calvin Gordon; Biology
1016		Modern solutions to a modern problem: Ergonomic designs to combat sedentary behaviour	Karman Shergill; Biology
Chemistry			

1100		Implementing a Community Service Learning Project in Analytical Chemistry II Lab	Kimberly Millis, Karen Ho and Hannah Grewal; Chemistry and Physics
1102		Enzyme activity following liquid-liquid phase separation in vitro	Kristian Smits; Chemistry and Physics
Environmental Science & Sustainability			
1300		Effect of Organic Liner Thickness on the Seepage Rate of Soil Matrix Columns using Enhanced Gleization Method	Khoa Dang, Braden Etzerza, Jarrett Porteous and Karel Beijer; Earth and Environmental Sciences
1301		Humic Acid effects on Glyphosate sorption on mature bean plants	Brittany Nelson, Philip Anderson, Ron Goyhman, Sergei Pisarev and Austin Zabel; Earth and Environmental Sciences
1302		Using the Tea Bag Index to Determine the Effect of Grass Root Rhizosphere Activity on Organic Matter Decomposition	Brendan Maddin, Jordan Hromyk, Melissa McCrady, Austin Braun and Mathew Eckford; Earth and Environmental Sciences
1304		Quantitative description of the environmental impacts of mining in Butte, MT using biomonitoring	Philip Anderson, Kevin Hayes, Brendan Maddin, Melissa McCrady and Austin Zabel; Earth and Environmental Sciences
Geography & Spatial Analysis			
1303		Suitability of the Ann and Sandy Cross Conservation Area (ASCCA) for American badger (Taxidea taxus) translocation	Rachel Pizante; Earth and Environmental Sciences
1400		GIS Modelling for Cellular Dead Zones in the Ann and Sandy Cross Conservation Area	Brittany Nixon; Earth and Environmental Sciences
1402		New Path Routing for the Ann and Sandy Cross Conservation Area	Riley Medd; Earth and Environmental Sciences
1404		Mobile Data Collection App: Monitoring Anthropogenic and Natural Disturbances in Conservation Areas Using GIS	Stephanie Gruber; Earth and Environmental Sciences
Geology			
1500		Sulphur Isotope Geochemistry of the Mount Milligan Cu-Au Porphyry Deposit	Kate Nicas; Earth and Environmental Sciences
1502		Petrologic analysis of fault-hosted sediment in the Middle Cambrian Burgess Shale—evidence for seafloor mud volcanism	Elyse Marzolf; Earth and Environmental Sciences
1504		Slippery schists - Unlocking metamorphic processes of mountain building in the Canadian Cordillera	Ryley Penner; Earth and Environmental Sciences

1506		Crustal Deformation: The Story of the Epidote-Graphite Calc-Silicate	Amira Taha; Earth and Environmental Sciences
1508		Serpentine: The Wet Conveyor Belt at Convergent Margins	Emily MacMillan; Earth and Environmental Sciences
1510		Dueling Deltas: Comparative Analysis of the Beaufort Mackenzie Basin and Tertiary Niger Delta	Cylenna Alexander; Earth and Environmental Sciences
1512		Controls on Water Quantity and Quality in the Shingle Spit-Phipps Point area, Hornby Island, British Columbia	Gareth Williams; Earth and Environmental Sciences
1514		Geologic features on the surface of Venus	Nkenjika Ngini; Earth and Environmental Sciences
1516		Corsican Serpentinite	Inam Jamil; Earth and Environmental Sciences
1518		North Carolina Eclogites	Devon Brown; Earth and Environmental Sciences
1520		Serpentinized Melanges of the Franciscan Complex	Matt Finnegan; Earth and Environmental Sciences
1522		The strain of building a mountain: an analysis of amphibolite facies schist from the Rocky Mountain Trench	James Climie; Earth and Environmental Sciences
1524		Case of Aggravated Basalt on the Shores of Lake Superior: Zeolite Facies Metamorphism of Michigan	Alen Poskovic; Earth and Environmental Sciences
1526		Biomarker Geochemistry as a Reservoir Surveillance Tool – Long Lake, AB	Mitchell Gillrie; Earth and Environmental Sciences
1528		Metamorphic Petrology in the Scottish Highlands	Matthew Gill; Earth and Environmental Sciences
1529		The Conniving Calcite Conundrum	Matthew Prince; Earth and Environmental Sciences
Mathematics & Computing			
1600		Spatial tracking of the current Ebola outbreak in Congo	Olga Koldachenko, Ashok Krishnamurthy, Loren Cobb, Michael Wendlandt and Murdoch McKinnon; Mathematics and Computing
Wildlife Behaviour, Conservation & Ecology			
1900		The Role of Canis latrans (coyote) in the conservation of biodiversity of the Ann & Sandy Cross Conservation Area (ASCCA)	Moroni Lopez Vasquez; Biology

Afternoon Session (2:00 PM - 4:00 PM)			
Poster		**Title**	**Author(s); Affiliation**
Cell & Organismal Biology			
1003		The Analogy Between Individual and Social Immune Systems in the Hymenoptera (bees, ants, and wasps)	Geraldhine Lopez; Biology
1005		Introducing Novel Mutations into Mcherry Protein to Determine the Importance of Serine 151 in Fluorescence.	Kelsey Turner and Millicent Brentnall; Biology
1007		Mutations at Glutamine 163 in mCherry Fluorescent Protein	Daphne Rose Joaquin, Caroline Basta and Damian La Rosa Montes; Biology
1009		Color transition in mCherry's fluorescence caused by point mutation of arginine 100 using site-directed mutagenesis	Jordan Brown; Biology
1011		Myogenic Clock: A Novel Model for Skeletal Muscle Development and Differentiation	Damian La Rosa Montes; Biology
1013		Root Hair Development is Unaffected in tt5, a Wax Deficient Mutant of Arabidopsis thaliana	Breanne Bali; Biology
1015		Carbonic Anhydrase Inhibitors: Structure, Function, and Application for the Prevention and Treatment of Acute Mountain Sickness	Britta Byman and Trevor Day; Biology
1017		Spectral Analysis and Mutation of mCherry Fluorescent Protein	Kendall Beaugrand, Kristian Smits and Darlene Skagen; Biology
Chemistry			
1101		Molecular Agoraphobia: The Effects of Crowding Agents on Enzymatic Reactions	Mohamed Haymour; Chemistry and Physics
1103		Characterization Of Chrome Powders With Different Nail Lacquers	Ornina Alameddin; Chemistry and Physics
1104		Investigating Protein Extraction from Soil for Further Downstream Analysis	Calvin Gordon; Chemistry and Physics
Computing, Technology and Communications			
1200		Web Accessibility Analysis of Western Canadian Universities: Do Accessibility Services Offer Accessible Websites?	Terrence Plunkett and Peter Morrison; Mathematics and Computing

Environment & Sustainability			
1305		Measuring the Effects of Soil Compaction on Germination Potential and Establishment of Four Flowering Plant Species Native to Southern Alberta in Controlled Polyculture and Monoculture Environments	Nabeel Abdul Basith, Nabeel Abdul Basith, Winston Jamieson, Sarah Morley, Chelsea Thomson and Alexandra Grant; Earth and Environmental Sciences
Geography & Spatial Analysis			
1401		Spatial Analysis of the Dispersal of Canada thistle (Cirsium arvense) onto the Ann and Sandy Cross Conservation Area	Kyrstin Stokes; Earth and Environmental Sciences
1403		Detailed Study of Precambrian Massive Sulfide Mineralization, Karrat Group, Western Greenland and Sunset Lake, Northwest Territories	Cristian Otalora and Michelle DeWolfe; Earth and Environmental Sciences
1405		GIS Modelling of Landcover Change of the Ann and Sandy Cross Conservation Area	Anne Neumann; Earth and Environmental Sciences
1406		GIS Spatial Analysis Approach for Carbon Sequestration on Grasslands and Forests at the Ann and Sandy Cross Conservation Area in Southern Calgary, Alberta	Stephany Villamil; Earth and Environmental Sciences
1407		Developing a field application for mapping poisonous species in the ASSCA	Kelsey Brockbank; Earth and Environmental Sciences
Geology			
1501		Unique and Destructive Deformation of a Blueschist pyllonite in North East Corsica Shear Zone	Dallan Beaudin; Earth and Environmental Sciences
1503		The Complex Relationship Between Proterozoic Metamorphic Events of the Colorado Rockies	Adam Gutsche; Earth and Environmental Sciences
1505		The East Tenda Massif sericite-epidote meta-granite	Carissa Schmidtke; Earth and Environmental Sciences
1507		Coesxistence of Glaucophane-bearing Blueschist and Eclogite of Rock Sample from Corsica, France Gives Key Evidence Towards Tectonic History	Cassidy Kitchen; Earth and Environmental Sciences
1509		Snakes on a (Fault) Plane	Natasha Campbell; Earth and Environmental Sciences
1511		Understanding the Emplacement of Messy Melanges	Jacob Lucyshyn; Earth and Environmental Sciences

1513		Lithostratigraphy Of The Sunset Rhyolite, Beaulieu Volcanic Belt, Slave Province	Shelby Austin-Fafard and Michelle DeWolfe; Earth and Environmental Sciences
1515		metamorphic petrology of an Ultra-High Temperature (UHT) granulite rock	Muhammad Azlan; Earth and Environmental Sciences
1517		Multilayered Coronitic Metagabbro	Nicole Boulton; Earth and Environmental Sciences
1519		CO_2 sequestration in subsurface Alberta brine—potential geologic mitigation of greenhouse gas emissions	Mathieu Boudreau, Paul A. Johnston, Francois Marechal, Jennifer J. Scott and Daniel T. Chupik; Earth and Environmental Sciences
1521		Problematic agglutinated tubes from the Late Cretaceous Bearpaw Formation, Alberta	Virginia Gold and Paul Johnston; Earth and Environmental Sciences
1523		Greenschist Skarn	Taylor Wasuita; Earth and Environmental Sciences
1525		What can a Meta-Gabbro Reveal about the History of the Grenville Orogenic Belt?	Samantha Warren; Earth and Environmental Sciences
1527		High-grade, boron bearing metamorphism of the Grenville Province	Conor Newton; Earth and Environmental Sciences
Wildlife Behaviour, Conservation & Ecology			
1901		The Role of Genetics & Parental Provisioning on Structural Plumage Coloration Development in Mountain Bluebird (Sialia currucoides) Nestlings	Nicole McClure; Biology
1902		Identifying the genetic loci responsible for pelvic polymorphism in Culaea inconstans (brook stickleback) populations in Alberta, Canada	Moroni Lopez Vasquez; Biology

Abstracts

Cell & Organismal Biology

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

Abstract title: The Effects of Relative Acute Hyperglycemia on Cardiac Autonomic Balance Between Sexes

Authors: Alexandra Skalk, Gary Saran, Zahrah Rampuri, Jan Elaine Soriano, Jeena Lorida, Tysen Joki, Sarah Hewitt, Trevor Day

Abstract

Males and females have differing cardiac autonomic functioning, possibly contributing to higher rates of cardiovascular disease in men with aging. In young, healthy populations, this sex difference in cardiovascular autonomic function has not been established. Acute glucose ingestion has been shown to stimulate a cardiovascular sympathetic response, likely through carotid body activation. We hypothesized that young men would have greater cardiovascular sympathetic responses following 75g glucose ingestion than women, measured through heart rate variability (HRV) metrics. We aimed to test the effects of acute relative hyperglycemia on HRV metrics to study differing cardiovascular autonomic function and responses between young, healthy men and women (19 females). Resting HRV was quantified from a 5-min average of lead II configured ECG in two ways: (1) frequency domain, with low frequency (LF) representing sympathetic activity, and high frequency (HF) representing parasympathetic activity, and (2) Poincaré plots, with SD1 representing parasympathetic activity and SD2 representing sympathetic activity. In both fasted and glucose loaded states, LF and HF domains were different between males and females, with males having increased LF values ($P<0.001$) and females having increased HF domain ($P<0.001$). SD1 was also significantly increased in females in both fasted and glucose loaded sates ($P=0.013$). Our data demonstrates a sex difference in cardiovascular autonomic functioning, with increased sympathetic outflow at rest in males, possibly contributing to higher rates of cardiovascular disease later in life. In contrast, females had increased parasympathetic outflow at rest, possibly offering clinical relevance in understanding reduced cardiovascular disease in women over the lifespan.

Keywords: physiology; cardiovascular; sex difference; autonomic control

Supervisor: Trevor Day

Poster #1001, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Cancer Stem Cell: The Fallen Angel

Authors: Sarina Falcione

Abstract

Stem cells represent a population of undifferentiated cells with limitless replicative capacity and the ability to differentiate into morphologically and functionally diverse cell-types, while maintaining a lineage of stem cells. The two major types of stem cells are embryonic stem cells (ESCs) and adult stem cells (ASCs). The ESCs are pluripotent cells capable of differentiating into virtually any cell-type and play a major role in developing embryos. Therapeutically, these cells have great potential to regenerate and repair non-functional tissue, albeit ethical issues preclude them from such an application. Tissue-specific ASCs on the other hand are similar, but less efficient when compared to ESCs in their ability to form a vast array of cell-types. These multipotent adult cells are capable of differentiation and regeneration within a specific tissue and have great therapeutic implications. While ESCs play a critical role during embryonic development as they contribute to the formation of functionally diverse cell-types, the ASCs are involved in repair and regeneration of adult tissues that are functionally deficient. In other words, stems cells are “angels” that protect highly differentiated tissues by replenishing aged

and dying differentiated cells. Like the "fallen angels" in the Abrahamic religions, these stem cells with unlimited ability to divide can, occasionally, result in cancer - a disease of uncontrolled cell division. Here, we propose a metaphorical model of stem cells that highlight the cellular and molecular mechanisms underlying the transition of a beneficial "angel-like" stem cell into a "fallen angel," the cancerous stem cell.
Keywords: Embryonic stem cells, Adult stem cells, Cancer stem cells
Supervisor: Kumar Chandrasekhar

Poster #1002, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Can urine pH measures be utilized to assess the renal acid-base responses during high altitude ascent?
Authors: Brandon Pentz, Trevor Day, Mingma Sherpa, Tom Brutsaert, Nathan Ackroyd, John Chik, Emily De Freitas, Emily Vanden Berg, Rupinder Sandhu, Cassandra Nysten and Jordan Bird
Abstract
The low atmospheric oxygen associated with high altitude ascent is a profound respiratory stimulant, eliciting a hypoxic ventilatory response and resulting in respiratory alkalosis. With respiratory alkalosis, kidneys compensate by eliminating bicarbonate in urine. In addition, carbonic anhydrase blockers (Diamox) are often administered during ascent to enhance this renal response. As such, monitoring acid-base homeostasis is often done by arterial blood draws, which are both expense and invasive.We aimed to characterize the utility of urine pH measurements as a surrogate for acid-base regulation during incremental high altitude ascent. We hypothesized that (a) urine pH will become alkalotic with ascent, reflecting renal compensation, and b) oral Diamox administration would further alkalinize urine pH compared to a control group. In two groups of trekkers, Diamox (D - 125 mg twice daily) and no Diamox (ND), we measured peripheral oxygen saturation (SpO_2; pulse oximeter), the pressure of end-tidal (PET)CO_2(portable capnograph), and urine pH (portable pH probe) during incremental ascent to 5160m over 10 days in the Nepal Himalaya. SpO_2decreased with ascent, but was not different between D and ND ($P<0.001$). $PETCO_2$also decreased with ascent ($P<0.001$), but was larger in magnitude for the D group. Urine pH was unchanged during ascent ($P>0.05$). However, urine pH in the D group was significantly higher at every altitude ($P<0.001$). Although urine pH appears not to be a feasible method for tracking renal responses during altitude ascent, Diamox had a clear effect, which warrants further study into the mechanisms underlying renal acid-base responses.
Keywords: carbonic anhydrase; Diamox; high altitude; respiratory alkalosis; urine pH
Supervisor: John Chik

Poster #1003, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: The Analogy Between Individual and Social Immune Systems in the Hymenoptera (bees, ants, and wasps)
Authors: Geraldhine Lopez
Abstract
This review of literature aims to research into the analogy between individual and social immune systems of bees, ants, and wasps. They are social species that comprise the order of insects known as the Hymenoptera. Eusocial insects live in common colonies and manifest particular immune system mechanisms to fight against invaders. Such immunity may be at the individual or collective level. To understand how collective immunity takes place it is crucial to appreciate individual immunity which is its foundation. This project was done through comparative analysis of reviewed and experimental research articles and relevant books to the field of immunity in the Hymenoptera. Key findings on three lines of defence (border, soma, and germline) are compared between the two types of immunity levels. Such results are used to propose two hypotheses: immune contributions from single individuals are beneficial for protecting an entire colony, while colony-wide efforts reciprocate immunity to its members. As well, necrophoric behaviour observed in bees and ants is maintained by altruism and/or

kin-selection. It was concluded that both immune levels complement each other and that the two types of necrophoric behaviour are present in bees and ants, but altruism is remarkably observed in wasps. Finally, from the observed pathogen-host interactions in the Hymenoptera, future investigations could be applied to understand immune systems of mammals further, since they resemble the organization observed in eusocial insects.
Keywords: Hymenoptera; social immunity; individual immunity; eusocial insects
Supervisor: Robin Owen

Poster #1004, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Effects of CO_2 on Regional Cerebral Blood Flow Regulation During Lower-Body Negative Pressure
Authors: Scott Thrall, Trevor Day, Rachelle Brandt, Kristi Wynnyk and Chantelle Green
Abstract
Anterior and posterior cerebral blood flow (CBF) is differentially regulated during (a) changes in CO_2 (cerebrovascular reactivity; CVR), and (b) acute hypotensive challenges (e.g. lower body negative pressure; LBNP). However, the effects of steady-state CO_2 perturbations on the CBF response to LBNP has not been investigated systematically. We aimed to investigate regional CBF responses to incremental LBNP in steady-state hypocapnia, normocapnia and hypercapnia in anterior and posterior cerebral circulations. We hypothesized that (a) posterior CBF would be better maintained during LBNP irrespective of CO_2, and (b) regional patterns of CBF regulation during LBNP would be unchanged across CO_2 perturbations. In 14 healthy participants, we measured heart rate (HR), mean arterial pressure (MAP), cerebral blood velocity (CBV) and cerebrovascular conductance (CVC; CBV/MAP) in the middle (MCA) and posterior cerebral arteries (PCA). We conducted three randomized incremental LBNP protocols (-20, -40, -60 and -80 mmHg; 3-min each) in hypocapnia (-8 mmHg; hyperventilation), normocapnia (room air), and hypercapnia (+8 mmHg; 5% inspired CO_2). HR increased incrementally with LBNP ($P<0.001$). At -80mmHg LBNP, MAP decreased in hypo- ($P=0.046$) and normocapnia ($P=0.002$). MCA and PCA CBV decreased in normocapnia ($P<0.001$ and $P=0.011$) and hypercapnia ($P<0.001$ and $P=0.002$). However, while MCA CVC decreased in normocapnia ($P=0.01$) and hypercapnia ($P<0.001$), PCA CVC was unchanged during LBNP at all levels of CO_2. Our results demonstrate greater anterior sensitivity during moderate LBNP superimposed with alterations in CO_2. Our data elucidate a comprehensive understanding of regional CVR during LBNP-induced hypovolemia, suggesting protection of posterior brain structures during hypovolemic shock.
Keywords: Cerebral blood flow; Carbon dioxide; Lower body negative pressure
Supervisor: Trevor Day

Poster #1005, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Introducing Novel Mutations into Mcherry Protein to Determine the Importance of Serine 151 in Fluorescence
Authors: Kelsey Turner and Millicent Brentnall
Abstract
The discovery of fluorescent proteins, such as red fluorescent protein, has helped advance our understanding of cellular and molecular processes. The area responsible for fluorescence is called the fluorophore. The fluorophore structure and environment are critical in order for proper function. mCherry, a variant of red fluorescent protein, has been widely studied and changed. Less research has been done on the amino acids that are close to the fluorophore when it is in its tertiary form. This study aims to look at one amino acid, serine 151 (S151), and its role in the fluorescence of mCherry. S151 interacts directly with the fluorophore through hydrogen bonding. A point mutation in the DNA was created using synthetic primers. S151, a polar uncharged amino acid, was targeted and changed into valine and alanine, which are both non-polar hydrophobic amino acids. The mutated plasmid DNA was

transformed into Escherichia coli were the bacteria created the fluorescent protein. The excitation and emission wavelengths where collected (n =3) to observe how the novel mutations affect the fluorescence compared to the control. mCherry has an accepted excitation and emission wavelength of 587nm and 610nm, respectfully. It is predicted that these changes will disrupt the hydrogen bonding to the fluorophore as well as affect the folding of the protein. Causing a disruption of the formation of the hydrophobic core. The mutations are predicted to produce a more orange colour of light to be emitted which is considered a blue colour shift in fluorescence.
Keywords: Site-directed Mutagenesis; mCherry; Fluorescent protein; Serine 151
Supervisor: Laura Atkinson

Poster #1006, Presentation Time: 10:00 am - 12:00 pm
Abstract title: RNA-seq detection of PD-L1 in lung Cancer and potential clinical applications
Authors: Reid McNeil
Abstract
The immune system is a network of molecules, cells, tissues and organs working together to protect the body. Within this network, the protein Programmed Death Ligand 1 (PD-L1) helps regulate the immune response, but if upregulated in tumours it helps cancer cells evade the immune system. Clinicians use immunohistochemistry (IHC) to quantify PD-L1 expression and for estimation of PD-L1 positivity to determine whether a patient will receive immunotherapy. However, with recent advancements in high-throughput genetic sequencing, RNA-seq can potentially replace IHC for PD-L1 detection. RNA-seq can be more accurate, effective, less expensive and less invasive than IHC. This project aims to assess the viability of RNA-seq in determining PD-L1 positivity in tumors compared to IHC. We predict a strong correlation between protein staining in tumors and mRNA expression in matched patients and that PD-L1 positive tumors determined by quantitative IHC should also be PD-L1 positive when quantified by RNA-seq. Demographic, qIHC and RNA-seq data of non-small cell lung cancer (NSCLC) tumours from 276 patients was obtained from the Glans-Look Lung Cancer Research database (University of Calgary). Statistical and graphical analyses were performed in Microsoft Excel (2018) and Jamovi (version 0.9.2.8) to examine the relationships between qIHC and RNA-seq data on PD-L1. The two methods to quantify PD-L1 showed correlational patterns of PD-L1 expression when compared (Students t-test [$p>0.05$], R^2 =0.928, one-way Anova [$p>0.05$]). PD-L1 is an important target for cancer immunotherapy, establishing more effective detection tool to confirm PD-L1 positive tumors has important clinical applications.
Keywords: PD-L1, RNA-seq, Cancer, Immunohistochemistry
Supervisor: Lars Petersen

Poster #1007, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Mutations at Glutamine 163 in mCherry Fluorescent Protein
Authors: Daphne Rose Joaquin, Caroline Basta and Damian La Rosa Montes
Abstract
Fluorescent proteins are used to visualize various molecules and organelles within the cell. Generally, these proteins consist of a beta-barrel and a chromophore where electrons are excited upon exposure to UV or visible light and release energy that is visually detected to the human eye. Previous studies demonstrated that mCherry, a dsRED-derived variant, exhibit an excitation and emission maxima of 587 nm and 610 nm, respectively. By mutating properly oriented amino acids near the chromophore, greater photostability and a shift towards a higher wavelength of the excitation and emission spectra have been reported. The scope of this research is to alter amino acid residue 163 into tryptophan, tyrosine or glutamic acid and to produce similar or better variants of the mCherry protein. We hypothesize that mutating amino acid glutamine 163 into tryptophan, tyrosine, or glutamic acid will shift the excitation and emission maxima of mCherry towards a higher wavelength. This is most likely

caused by π-π interactions between the aromatic rings of tryptophan or tyrosine with that of the chromophore. Also, the negatively charged glutamic acid can form ionic and hydrogen bonds with the chromophore, strengthening the bonds in the inner core of the molecule. Through site-directed mutagenesis, glutamine at residue 163 is mutated into tryptophan, tyrosine, or glutamic acid. Analysis and comparison of the fluorescence intensity spectra will give us a better understanding of the effects of the mutations which could allow creating new mCherry derivatives with better fluorescence properties.
Keywords: Fluorescent proteins; mCherry; Glutamine; Site-directed mutagenesis
Supervisor: Laura Atkinson

Poster #1008, Presentation Time: 10:00 am - 12:00 pm
Abstract title: The Effects of Acute Hyperglycemia on Central Respiratory Chemoreflex Magnitude
Authors: Jordan Bird, Trevor Day, Nick Strzalkowski, Scott Thrall and Alexandra Skalk
Abstract
Peripheral chemoreceptors (PCRs; carotid bodies) and central chemoreceptors (CCRs; throughout brainstem) modulate ventilation. PCRs respond to various chemostimuli, including O_2, $CO_2/[H^+]$, glucose, insulin and heat, acting as metabolic sensors. However, CCRs have only been previously characterized as $CO_2/[H^+]$ sensors. We aimed to characterize the relationship between alterations in blood glucose and central respiratory chemoreflex responsiveness using hyperoxic rebreathing in healthy humans. We hypothesized that experimentally-induced relative hyperglycemia post oral glucose tolerance test (OGTT) would (a) increase the rate of CO_2 accumulation during rebreathing and (b) augment central respiratory chemoreflex responsiveness due to a synergistic effect of hyperglycemia on the CO_2 sensitivity of CCR neurons. In 13 healthy, fasted participants, we measured resting minute ventilation (L/min; pneumotachometer) and end-tidal carbon dioxide ($P_{ET}CO_2$; Torr; calibrated gas analyzer) and performed a hyperoxic rebreathing test before and after ingestion of a 300ml, 75g OGTT. The hyperoxic rebreathing test isolated CCRs and quantified central chemoreflex responsiveness to accumulation of metabolically-derived CO_2. Blood glucose levels were higher 30-min following the OGTT beverage than fasted (7.7±1.0 vs. 4.7±0.5 mmol/L; $P<0.0001$). During rebreathing, the rate of $P_{ET}CO_2$ accumulation was higher in the glucose loaded trial compared to the fasted trial (0.088±0.007 vs. 0.070±0.007 Torr/sec; $P<0.0001$). However, the central respiratory chemoreflex responsiveness was not different between glucose loaded and fasted trials (2.1±1.3 vs. 2.1±1.6 L/min/Torr CO_2; $P=0.7$). Our data suggest CCRs may be more specialized respiratory chemoreceptors compared to the PCRs, exclusively detecting metabolically-derived changes in $CO_2/[H^+]$.
Keywords: chemoreceptors, hyperglycemia, carbon dioxide, ventilation
Supervisor: Trevor Day

Poster #1009, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Color transition in mCherry's fluorescence caused by point mutation of arginine 100 using site-directed mutagenesis
Authors: Jordan Brown
Abstract
Fluorescent proteins are a key feature used in biotechnology that contributes to the depth of understanding in cellular research by acting as markers in studying organization and functions of living organisms. The mCherry fluorophore has three main areas that are interacting in polar contacts that form a conjugate pi bond system. However, there is little research that investigates how these contacts affect the overall fluorescence. This study focuses on the arginine at 100 that interacts directly with the mCherry fluorophore through polar contacts. This arginine will be changed into a glutamic acid by synthesizing specific DNA primers. Using these primers, site-directed mutagenesis gives the ability to

conduct a point mutation to the mCherry plasmid DNA. This mutated mCherry plasmid is then transformed into E. coli that will express the fluorescent protein. These fluorescent proteins are then analyzed and compared to the mCherry excitation maximum at 587nm and the emission maximum at 610nm. Glutamic acid is a negatively charged, polar amino acid that when substituted is predicted to cause a loss of polar contact to the fluorophore. This will decrease the polar density resulting in a shift toward shorter wavelengths (blue-shift) in the fluorescent emission. Further studies into these polar contacts will increase the understanding of how they impact the fluorescence signals and how this can be used to further cellular research.
Keywords: mCherry, fluorescence, arginine 100, site-directed mutangenesis
Supervisor: Laura Atkinson

Poster #1010, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Characterizing Pectic Cell Wall Epitopes in the Argenteum mutant of Pea (Pisum sativum).
Authors: Damian La Rosa Montes
Abstract
The Argenteum (Arg) mutation of the common garden pea (Pisum sativum) has a distinctive gray-green appearance of the leaves, which contrasts sharply with the green of healthy leaves. Previous work demonstrated that this appearance is caused by extensive air spaces beneath the leaf epidermis and an unusually loose adherence of the epidermis to the underlying cells of the leaf. Plants cell walls consist of up to three layers. From the innermost, these layers are identified as secondary cell wall, primary cell wall and the middle lamella, which originates between the primary cell walls of adjacent cells. Pectins, which are the most abundant polysaccharides in the middle lamella, consist mainly of homogalacturonan (HG), rhamnogalacturonan-1 (RG-1) and rhanmnogalacturonan-2 (RG-2). These pectins are characterized by exhibiting diverse structural composition that collectively participates in cell adhesion and separation. However, the role of each individual structure is not known. Although some attempts have been made to understand how the cell walls of Argenteum plants are different, the architecture of the mutant's cell wall remains unclear. We hypothesize that an alteration of the middle lamella causes the loose adherence of the epidermis. The scope of this research is to characterize the epitopes of the cell wall by conducting immunological screens of antibodies raised against a wide range of pectic epitopes. The findings will not only contribute to developing knowledge about the cell wall architecture of Argenteum mutants but also to gaining a better understanding of the complexity of pectin.
Keywords: Pectin; Cell wall epitopes; Argenteum (Arg) mutant, pea (Pisum sativum); Middle lamella
Supervisor: David Bird

Poster #1011, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Myogenic Clock: A Novel Model for Skeletal Muscle Development and Differentiation
Authors: Damian La Rosa Montes
Abstract
Skeletal muscle exhibits incredible regenerative properties; however, some defects during embryonic muscle development can result in various forms of progressive muscle disorders with poor prognosis. Understanding the regulatory circuits that control the formation and development of muscle during embryonic, fetal, and postnatal stages provide a molecular blueprint for developing novel therapies. Previous work demonstrates that myogenesis, the process of muscle development, is generally orchestrated by two main families of regulatory proteins: Pair Box Proteins (Pax3/7) and Myogenic Regulatory Factors (e.g. Myf5, MyoD and MyoG). These proteins work consecutively and temporally to activate a cascade of gene expression that leads to the formation and growth of muscle fibres. However, this view implies rather a directional mechanism, leaving out the ability of resident muscle

stem cells to differentiate into functional muscle cells. Here, we propose a novel clockwise model for myogenesis that attempts to provide mechanistic insight into embryonic skeletal muscle development and adult muscle stem cell differentiation.
Keywords: Skeletal msucle developent; Stem cell differentiaiton; Myogeneic model; Embryonic myonenesis; Fetal myogenesis
Supervisor: Kumar Chandrasekhar

Poster #1012, Presentation Time: 10:00 am - 12:00 pm
Abstract title: The Impact of Five Amino Acid Characteristics on the Fluorescent Properties of Citrine
Authors: Breanne Bali, Savahnna Wolfe, Maddie Stewart, Reid McNeil, Mohamed Haymour and Reid Andersen
Abstract
Fluorescent proteins have revolutionized cellular and molecular biology. They allow researchers to examine subcellular localization, protein expression and molecular interactions with ease. Their fluorescence is controlled by the fluorophore, an excitable system of conjugated pi electrons within the hydrophobic core of the protein. Specific amino acids (AAs), like tyrosine in position 203 (Y203) within Citrine, contribute to the fluorescent properties of the fluorophore. To better understand the interaction between Y203 and the fluorophore, we aim to use a PCR technique known as site-directed mutagenesis to alter the DNA nucleotide sequence in position 203. This will effectively change the current tyrosine to 6 different AAs: glycine, threonine, asparagine, phenylalanine, serine and lysine. Through these mutations we aim to decipher the role that the aromatic groups, hydrogen donor groups, polarity, charge and size of these AAs, play on the characteristics of Citrine fluorescence. We will measure the wavelength of light that excites the fluorophore, and the wavelength emitted thereafter and compare this to the control excitation and emission wavelengths of 515nm and 520nm. We collectively hypothesize that mutations that eliminate aromatic groups and reduce steric hindrance within the hydrophobic core will cause a shift in the excitation and emission maxima towards shorter wavelengths (blue shift), while mutations that introduce charged or polar molecules could prevent fluorescence due to destabilization of the hydrophobic core.
Keywords: Fluorescent Proteins; site-directed mutagenesis; Citrine; Fluorescent Properties
Supervisor: Laura Atkinson

Poster #1013, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Root Hair Development is Unaffected in tt5, a Wax Deficient Mutant of Arabidopsis thaliana
Authors: Breanne Bali
Abstract
A layer of wax coats the epidermis of all land plants and protects them from various environmental factors, including desiccation. This wax is formed in the endoplasmic reticulum (ER) before it is transported to the plasma membrane (PM) and then through the cell to the epidermis, via a mechanism that is largely unknown. The tt5 mutant of Arabidopsis thaliana displays reduced amounts of wax on the surface but does not have a deficiency in wax biosynthetic gene expression. Given this, studying the mutant may provide insights into the transport mechanism of cuticular wax. We aimed to indirectly examine transport between the ER and PM, specifically focusing on the efficiency of Golgi-mediated secretion through observations of root hair growth characteristics. Root hairs offer insights into the efficiency of Golgi-mediated secretion as their growth directly depends on how well the Golgi can deliver cell wall materials to them. We hypothesized that tt5 plants would display reduced density, length and growth rate of root hairs. I measured these root hair characteristics in 4-day old A. thaliana seedlings and observed no change between the mutant and wildtype seedlings suggesting that impaired Golgi-mediated secretion may not be responsible for the wax deficiency noted in tt5. Future research

could involve directly examining Golgi-mediated secretion or other aspects of transport to better understand the mechanism behind the wax deficiency observed in tt5.
Keywords: Arabidopsis thaliana; Wax; Golgi-mediated Secretion; Root Hairs
Supervisor: David Bird

Poster #1014, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Embryonic and Adult Stem Cells: Fraternal Twins that are Close, but Different
Authors: Calvin Gordon
Abstract
Embryonic stem cells (ESCs) and adults stem cells (ASCs) are self-renewing undifferentiated cells possessing the ability to differentiate into somatic cells. Past these commonalities, the two entities differ dramatically, filling distinctly different roles. The developmental process an ESC or ASC undergoes is precise and definitive, such an expansive process has been difficult for stem cell biologists to comprehend. Each take on vastly different routes of development which are a result of major signaling pathways often dictated by the extrinsic environment that surrounds them. Significant signaling pathways of ESCs serve to maintain their pluripotent characteristic, the ability to differentiate into any three of the germ layers. Numerous pathways have been studied, BMP, FGF, and Wnt are prominent in producing pluripotent effectors. In contrast, ASCs are multipotent and do not have the luxury of specializing into any three of the germ layers. Already committed to one of the three germ layers, ASCs differentiate further into functional cells contributing to their respective tissue. Similar to ESCs, signaling pathways dictate ASCs differentiation; however, their pathways differ significantly. Notch, Hedgehog, and Wnt, all involved in the differentiation of ASCs, have been heavily researched. The degree to which each pathway is present dictates the specialization of the ASC, often in response to the niche of the ASC. This poster will establish and contrast the development of ESCs and ASCs through the comparisons of previously mentioned signaling pathways and the role of the niche on both entities.
Keywords: Stem Cell; Embryonic Stem Cell; Niche; Adult Stem Cell
Supervisor: Kumar Chandrasekhar

Poster #1015, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Carbonic Anhydrase Inhibitors: Structure, Function, and Application for the Prevention and Treatment of Acute Mountain Sickness
Authors: Britta Byman and Trevor Day
Abstract
It is essential to maintain physiological pH (~7.4) for normal functioning of the human body. Alterations in acid-base homeostasis can negatively affect health. However, manipulation of acid-base balance can also be used to treat illnesses in a variety of complex contexts (e.g. high altitude ascent). Carbonic anhydrase (CA), an enzyme that accelerates the conversion between CO_2 and HCO_3^-, plays an important role in the preservation of physiological pH and normal functioning of various organ systems (e.g., kidneys). CA inhibitors, mainly the sulfonamides methazolamide (MZ), acetazolamide (AZ), and benzolamide (BZ), inhibit CA, creating a metabolic acidosis through their effects on the kidney tubules. Structural differences between MZ, AZ and BZ result in the differential membrane permeability of each drug (high to low permeability, respectively). Furthermore, these differences in permeability in part accounts for the efficacy and variety of side effects reported by patients. Acute mountain sickness (AMS) develops at high altitude due to the effects of lower available O_2 (hypoxia). A hypoxia-induced ventilatory response creates a respiratory alkalosis through reductions in systemic CO_2. CA inhibition, normally by oral acetazolamide (Diamox), is commonly used for prevention and/or treatment of AMS, improving ventilation and oxygenation. However, AZ elicits a variety of unpleasant side effects that may limit compliance, owing to its penetration throughout

tissues. BZ may more precisely inhibit extracellular carbonic anhydrase in the kidney tubules, owing to its low membrane permeability, reducing the development of side effects. These properties may make BZ ideal for treatment of AMS during ascent to high altitude.
Keywords: Carbonic anhydrase inhibitor; acute mountain sickness; carbonic anhydrase; acetazolamide; benzolamide; methazolamide
Supervisor: Trevor Day

Poster #1016, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Modern solutions to a modern problem: Ergonomic designs to combat sedentary behaviour
Authors: Karman Shergill
Abstract
Prolonged sitting has become a prevalent feature of the modern workforce and is associated with numerous negative health effects (Koepp et al., 2016). The rise in sedentary behaviour has created a sitting disease epidemic that is affiliated with cardiovascular disease (Hamilton et al., 2008), diabetes (Wilmot et al., 2012) and musculoskeletal problems such as low back pain (Wilder et. al., 1998). Workplace culture is unlikely to change therefore modern solutions are required to address sedentariness. A variety of ergonomic interventions have been designed to prevent and reduce sitting disease pathologies that include: treadmill and standing desks, foot-fidgets, and exercise balls. These active workstations promote physical activity while performing computer tasks, however are limited in effectiveness in long-term health outcomes and can interfere with workflow (Commissaris et al., 2014). A recent ergonomic approach is the use of dynamic office chairs which adapt the motions of an exercise ball yet in a more controlled fashion to promote active sitting (Merritt and Merritt, 2007). Active sitting engages core muscles (De Carvalho et al., 2017), rehydrates intervertebral discs (Pape et al., 2018), and decreases lumbar lordosis (Kuster et al., 2016). Considering the progression of sedentariness and ergonomic solutions, the objectives of this review are: I) to discuss sitting disease and the associated health consequences, and II) highlight modern ergonomic interventions.
Keywords: Sitting disease; ergonomics; active sitting; human health
Supervisor: Nicholas Strzalkowski

Poster #1017, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Spectral Analysis and Mutation of mCherry Fluorescent Protein
Authors: Kendall Beaugrand, Kristian Smits and Darlene Skagen
Abstract
Fluorescent proteins are a fundamental tool in biological research, allowing researchers to monitor gene expression, specific protein-protein interactions, and cellular processes such as localization and dynamics of specific organelles. Monomeric variants of DsRed, such as mCherry, have been developed with improved brightness and photostability. mCherry derives its fluorescent shift towards longer wavelengths from an extended conjugated double-bond system around its three amino acid fluorophore. This study aims to observe changes in fluorescence of mCherry by introducing a point mutation using site-directed mutagenesis at position 70 near the fluorophore, mutating the phenylalanine to an arginine, serine, or tyrosine. Replacing a hydrophobic amino acid with either a hydrophilic or electrically charged amino acid should disrupt the microenvironment of the hydrophobic pocket surrounding the fluorophore. We hypothesize this will result in a shift towards shorter wavelengths, resulting in a color toward the blue end of the visible spectrum in the case of arginine and serine, and the absence of fluorescence in the case of tyrosine. Control fluorescence was found to have excitation and emission maxima of 587 and 610 nm, respectively. Shifts in excitation and emission maxima from control to mutagenized protein fluorescence spectra will be analyzed. This type of research has the potential to produce new variants of fluorescent proteins that can be employed to further biological research.

Keywords: mCherry; Fluorescence; Mutation; Excitation; Emission
Supervisor: Laura Atkinson

Chemistry

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

Abstract title: Implementing a Community Service Learning Project in Analytical Chemistry II Lab

Authors: Kimberly Millis, Karen Ho and Hannah Grewal

Abstract

A semester-long Analytical Chemistry II Community Service Project was piloted at Mount Royal University, focusing on the qualitative analysis of drinking water. Research students previously developed in-house methods to determine the concentration of various cations and anions in water. This protocol was used to ensure that the Total Dissolved Solids in drinking water were within the acceptable range as indicated by the Canadian Drinking Water Guidelines. This project was conducted with Westmount Charter Mid-High School as the community partner. The project took on a participatory learning approach, in which grade 8 students and research students collaboratively collected the samples, as per the City of Calgary's water sampling procedure. Research students tested the water samples, analyzed the data, and compared the findings to the City of Calgary Bearspaw Water Treatment Plant Summary. The results were disseminated, in correlation with the Alberta Grade 8 Science Curriculum, to the community partner. The future of this project is to engage with more community partners around Calgary to test the quality of drinking water in their facilities.

Keywords: community service project; drinking water; community partner; participatory learning

Supervisor: Karen Ho

Poster #1101, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Molecular Agoraphobia: The Effects of Crowding Agents on Enzymatic Reactions

Authors: Mohamed Haymour

Abstract

The intracellular environment contains ample macromolecules, making up 20-30% of its volume. Traditional in vitro enzyme kinetics experiments conducted in dilute solutions do not properly simulate this cellular state of macromolecular crowding: a phenomenon where the presence of crowding agents reduces total volume for enzyme activity. Crowding agents, such as dextran, are often used to simulate these cytosol conditions in vitro. Unlike previous studies, this project examines the kinetics of p-nitrophenyl acetate (PNPA) hydrolysis catalyzed by different enzymes, such as α-Chymotrypsin (αCT) and Bovine Carbonic Anhydrase (BCA) under identically crowded conditions and using the same substrate. We hope this will allow a clearer view of the effects of crowding on the enzymes themselves. In past studies, these effects were obscured by the use of different solution conditions (i.e. pH, buffer and salts) and substrates. PNPA hydrolysis will be followed using a UV-spectrophotometer reading at 405 nm. The measured initial rates will be fitted to the Michaelis-Menten equation in order to determine Vmax and Km for the control and crowded conditions. These values will be analyzed using classic ideas of competitive and uncompetitive inhibition. This study is a step towards understanding enzymatic reactions in the context of the actual cellular cytosol conditions and will provide means for translating in vitro results into their actual in vivo counterpart.

Keywords: crowding; macromolecules; enzymes; kinetics

Supervisor: John Chik

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

Abstract title: Enzyme activity following liquid-liquid phase separation in vitro

Authors: Kristian Smits

Abstract
Cells have many different mechanisms in place to separate and organize biochemical reactions within their confines. This allows for a variety of microenvironments that are optimized for specific functions. Most of this organization is done through membrane-bound organelles in which phospholipid bilayers surround and segregate these reactions from the rest of the cell. Examples of these are the well-known Golgi, mitochondria, and nuclei. Less well appreciated are membraneless organelles, such as stress granules and p-bodies, which lack a phospholipid bi-layer. Many membraneless organelles are involved in transcription and translational control, energy storage and many other critical roles. These membraneless organelles are characterized as liquid-liquid phase separated systems in which the concentration of proteins, nucleic acids, and other solutes are significantly higher within the liquid droplets versus the surrounding cytosol. There has been some research investigating the conditions in which these "liquid-liquid" phase separated systems form in vitro, but the behavior of enzymes in this system is uncharacterized. Utilizing fluorescently labeled micrococcus lysodeikticus, the enzyme activity of both phase-separated and homogeneous hen-egg white lysozyme solutions will be measured and compared. This research is important because the possible increase or decrease in activity seen could be critical in understanding the role that these systems play in the cellular environment.
Keywords: enzymes, phase separation, lysozyme, kinetics, nucleoli
Supervisor: John Chik

Poster #1103, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Characterization Of Chrome Powders With Different Nail Lacquers
Authors: Ornina Alameddin
Abstract
The purpose of this research project is to characterize several chrome powders with different reflective effects as well as 4 different nail which are clear gel, water-based, and regular top coats. In addition, the physical and chemical properties of their interaction is also presented.
First, each of the reflective chrome powders was analyzed for organic compounds using infrared spectroscopy (Raman XDR and Nicolet Is5 FTIR). Also, x-ray diffraction was used to determine the metallic elements present on them. Secondly, IR spectroscopy was used for an organic chemical analysis of the nail lacquers in liquid and dry form to establish any possible chemical shifts in the absorption spectra. Since each of the nail lacquers differ in terms of drying procedures, polymerization and evaporation, IR spectroscopy was also used to analyze the interaction between the chrome powders and the nail lacquer. The liquid powder interphase may provide structural differences; therefore, scanning electron microscopy (SEM) was used to visualize this interphase and study the possible structural color properties and reflective effects. This study presents an interesting example how nail fashion and science can be interrelated. It promotes further research on this topic as it is a growing trend. Since these chemicals are being used more frequently, it is important to understand the characteristics and mechanisms of how these polishes work and can be manipulated to get the best out of their reflective effect based on scientific principles.
Keywords: Chrome, powder, polish, nail
Supervisor: Manuel Diaz-Avila

Poster #1104, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Investigating Protein Extraction from Soil for Further Downstream Analysis
Authors: Calvin Gordon
Abstract
Microbiota excreted enzymes play a vital role in maintaining soil composition and health. Analytical techniques such as liquid chromatography coupled to mass spectrometry have improved the ability to identify enzymes within this environment. In order to utilize these techniques, proteins must be

extracted from the soil. The abundance of interfering soil components, such as humic substances which tightly bind proteins, can significantly decrease the amount of measurable protein and thus impede enzyme identification. This project started with examining two extraction methods to determine which is better. The first utilized single and then multiple washes with sodium citrate (SC) at an elevated temperature in order to remove the protein from soil. For the second, a sodium dodecyl sulfate and phenol (SP) solution was employed with sonication in an effort to localize the protein to a separate layer away from the humic substances. Using the Bradford concentrate assay, the SC method proved to be substantially more effective in removing protein from the soil. In addition, multiple uses of SC washing appeared to remove humic substance as a significant decrease in solution darkness was observed. Following 90% trichloroacetic acid precipitation, definitive bands were detected by SDS-electrophoresis from the SC extraction method. The extraction method which calls for the soil to be washed and boiled multiple times with sodium citrate buffer shows promise for identifying enzymes present in the soil.

Keywords: Soil proteomics; Soil protein extraction; Soil enzymes; Protein identification

Supervisor: John Chik

Computing, Technology and Communications

Poster #1200, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Web Accessibility Analysis of Western Canadian Universities: Do Accessibility Services Offer Accessible Websites?

Authors: Terrence Plunkett and Peter Morrison

Abstract

Web accessibility in educational services is of increasing importance with the growing availability of online services and their integration in many facets of the post-secondary education system. One such service is the online accessibility service that universities offer. Considering the broad range of the target audience for such services, university accessibility service Web pages should be designed with special attention to Web Content Accessibility Guidelines (WCAG) provided by World Wide Web Consortium. The goal of this study is to empirically analyze the landing Webpage for accessibility services Websites in western Canadian universities and report on the common type of accessibility issues in these pages. To achieve this goal, an automated tool is used to evaluate the compliance of the Webpages to WCAG 2.0 guidelines. The results of the tool are then verified manually at the researcher's discretion. Further manual analysis is conducted to cover the aspects of Web accessibility that cannot be assessed automatically. The results of our two-stage analysis reveal that most of the universities under study need to take further steps to improve the accessibility of their Websites, specifically, their accessibility services Webpage. We aggregate the results and report on type of the issues we identified and their frequency. Moreover, we report the limitation of the automated accessibility analysis as we identified in our study. Our results can raise awareness about the importance of Web accessibility among organizations who offer online services and students who may choose Web development as their future career.

Keywords: Web Accessibility; Web Design; Web Content Accessibility Guidelines (WCAG); Western Canadian Universities

Supervisor: Yasaman Amannejad

Environmental Science & Sustainability

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

Abstract title: Effect of Organic Liner Thickness on the Seepage Rate of Soil Matrix Columns using Enhanced Gleization Method

Authors: Khoa Dang, Braden Etzerza, Jarrett Porteous and Karel Beijer

Abstract

Freshwater is required in agriculture for crop irrigation and livestock watering. Therefore, on the prairies, water reservoirs or "dugouts" have long been used to store diverted stream water or captured rain and snow runoff. Farmers and ranchers who rely solely on intermittent precipitation to fill their dugouts cannot afford substantial water loss. Water loss can be from evaporation but it can also be impacted by seepage into the ground from coarse textured or highly calcareous soils. One low cost method of dealing with this is through enhanced gleization. Enhanced gleization method uses a layer of organic material such as straw or manure to speed up the anaerobic state of a subsoil which has been shown to decrease water seepage. Enhanced gleization is relatively inexpensive and utilizes materials found on farms. Our study was designed to build upon past enhanced gleization research as there has not been any new research in this area since 1978 and there is no literature testing optimal thickness of the organic liner. We theorized that increasing the thickness of the organic liner application of 5 kg/m2 by 3 and 10 times will reduce the seepage rate of our matrix to 0.05 cm/hr in a reduced time span. Analysis was conducted using soil matrix columns with four treatments, replicated three times, all with a constant water level. Experimental data will be used to determine if increasing the thickness of the organic liner is a viable option for reducing seepage loss in dugouts.

Keywords: Gleization, Agriculture, Water Management

Supervisor: Mathew Swallow

Poster #1301, Presentation Time: 10:00 am - 12:00 pm

Abstract title: Humic Acid effects on Glyphosate sorption on mature bean plants

Authors: Brittany Nelson, Philip Anderson, Ron Goyhman, Sergei Pisarev and Austin Zabel

Abstract

Glyphosate is one of the most widely used herbicides in agriculture to remove unwanted and invasive vegetation. Humic acid is an aliphatic organic substance that is derived from microbial activity and decaying of plant tissue. Past studies suggest that humic acid enhances the growth of plants and uptake of specific ions through enzymatic stimulation and increase of protein synthesis. The high molecular size and high stereochemical flexibility of glyphosate allows the molecule to bond onto humic materials, and thus is able to be absorbed and transported by humic substances. This study explores the potency of glyphosate when mixed with humic acid through testing different mixtures of the substances on mature bean plants, which is currently an emergent claim in the agricultural sector. The humic acid concentrate was added uniformly throughout each of the three mixtures. A Domestic Roundup with an application rate of 356 g/L of glyphosate was used on the samples. Glyphosate concentrations were separated into high, medium and low concentrations, which were at 100%, 50% and 10% variants, respectively. The plants were monitored for seven days daily until plant degradation was noticed. They were then cut from the stem, weighed, dried and measured for biomass. Effectiveness of the treatments were based on how the plants degraded in terms of physicality and mass.

Keywords: humic acid, glyphosate, mixtures, bean plants, sustainability

Supervisor: Mathew Swallow

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

Abstract title: Using the Tea Bag Index to Determine the Effect of Grass Root Rhizosphere Activity on Organic Matter Decomposition

Authors: Brendan Maddin, Jordan Hromyk, Melissa McCrady, Austin Braun and Mathew Eckford
Abstract
Soil organic matter depletion is becoming a prevalent environmental issue in the face of improper cultivation practices. Organic matter plays an important role in soil systems by improving water retention, pH buffering, and erosion control. Proper agricultural management is required in order to preserve and rebuild organic matter in our soils. One potential management technique is to vegetate soils to facilitate organic matter formation within depleted soils. Plant residues (soil organic matter) are incorporated into soils through biological processes that are affected by the chemical and physical properties of the soil. Within a soil, the area affected by plant roots is called the rhizosphere; this area is influenced by microorganisms and root secretion activity. There has been a debate in the scientific community about whether rhizosphere activity will inhibit or promote the decomposition of organic matter due to the competition between roots and microorganisms for nutrients. The Tea Bag Index makes use of green tea (simple organic matter) and rooibos tea (complex organic matter) to measure the decomposition rates of various plant residues based on loss of mass. To investigate this, vegetated and non-vegetated samples with the two teabag types will be incubated for a total of forty days in ten-day time intervals. The result of this experiment will help examine what role grassroots have in organic matter decomposition.
Keywords: Soil organic matter; tea bag index; grass roots; rhizosphere; sustainable agriculture
Supervisor: Mathew Swallow

Poster #1304, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Quantitative description of the environmental impacts of mining in Butte, MT using biomonitoring
Authors: Philip Anderson, Kevin Hayes, Brendan Maddin, Melissa McCrady and Austin Zabel
Abstract
In the 1880s, Butte, Montana was home to one of the richest mineral deposits in the world. Today, the region is home of two one of the most toxic superfunds sites in America, the Anaconda Smelter Site and the Berkeley Pit. In an effort to describe past and present air pollutant emissions in the Butte area we employed biomonitoring and dendrochronological techniques. Pine needle, bark, and core samples were collected from trees adjacent to the superfund sites. These samples were digested and analyzed using inductively coupled plasma mass spectrometry (ICPMS). The goal of this analysis is to quantitatively determine the levels of heavy metals over the last century and if this data can be related to mining activities in the region. Our results may indicate the cease of smelting activities in the 1980s and what if any persistent heavy metal contamination exists in the area.
Keywords: Biomonitoring, heavy metals, air pollution, mining
Supervisor: Gwen O'Sullivan

Poster #1305, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Measuring the Effects of Soil Compaction on Germination Potential and Establishment of Four Flowering Plant Species Native to Southern Alberta in Controlled Polyculture and Monoculture Environments
Authors: Nabeel Abdul Basith, Nabeel Abdul Basith, Winston Jamieson, Sarah Morley, Chelsea Thomson and Alexandra Grant
Abstract
Natural soil is composed of soil particles, minerals, organic matter and pore spaces of air and water. Soil compaction occurs when an above-ground force causes the densification of soil, increasing bulk density and purging air and water molecules from pore spaces. Anthropogenic soil compaction is due to activities such as foot traffic, heavy machinery used for construction and other human induced effects. Since urban areas experience more human activities, it is important to examine the effects of urban soil compaction on plant communities. Studies have shown that compacted soils limit the germination

potential and establishment of seeds, as the compressed soil limits root penetration into the soil matrix, hindering the uptake of water and nutrients. This experiment examines the germination potential and establishment of four flowering plant species in compacted soil. The plants selected are native to the southern Alberta region - Achillea millefolium (Yarrow), Campanula rotundifolia (Harebell), Antennaria rosea (Rosy Pussytoes), and Potentilla diversifolia (Smooth-leaved Cinquefoil). Studies have indicated that plant growth in polycultures were more successful than in monocultures, while providing a diverse habitat to support a greater variety of pollinator species. This experiment will test if plants in a polyculture environment can benefit from the presence of other species for germination potential and establishment, with simulated urban soil compaction. Implications from this study include a better understanding of deteriorating habitat for pollinator species and the preference of native flowering plants for revegetation of disturbed areas.

Keywords: Soil Compaction; Native Flowers; Southern Alberta; Poly-cultures; Germination Potential

Supervisor: Mathew Swallow

Geography & Spatial Analysis

Poster #1303, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Suitability of the Ann and Sandy Cross Conservation Area (ASCCA) for American badger (Taxidea taxus) translocation
Authors: Rachel Pizante
Abstract
The purpose of the Ann and Sandy Cross Conservation Area (ASCCA) is to protect habitat and provide space for native species. Although they are a native species, American badgers (Taxidea taxus) are considered a pest by many in the agricultural industry and are often killed when found on rangeland or cropland. ASCCA has been discussing the possibility of translocating American badgers to the property from an adjacent rangeland who would like to remove the badgers from their property. To potentially obtain a translocation permit from the Alberta government, a suitability map must be created. The suitability map was created using Geographic Information Systems (GIS) to identify areas of best, good, marginal, and poor badger habitat across ASCCA. This project considered soil type, slope, aspect, vegetation type, and past badger burrow locations as variables for preferred badger habitat. Slope and aspect data was created through GIS analysis of an elevation model.
Keywords: GIS, environment, reintroduction, mammal, habitat
Supervisor: Lynn Moorman

Poster #1400, Presentation Time: 10:00 am - 12:00 pm
Abstract title: GIS Modelling for Cellular Dead Zones in the Ann and Sandy Cross Conservation Area
Authors: Brittany Nixon
Abstract
The Ann and Sandy Cross Conservation area (ASCCA) south of Calgary consists of a rolling landscape with many areas of limited line of sight from cellular towers. This results in limited cellular service poseing a safety risk to people who become lost or injured in the area and are unable to contact EMS or management staff for help. The area is open to the public year-round and receives thousands of visitors annually. This project identifies the concerning dead zone spaces that are not receiving cellular signal from the tower on a hazard map. This data input was generated from a digital elevation model and processed using a GIS which created a terrain and cellular signal model which allowed for spatial analysis of the area to produce the map. The map identifies three levels of hazard using viewsheds and cellular relays to identify line of sight from the towers and signal boosters to the hiking paths. A GeoApp was created to aid in future collection of cellular signal information, and a Story Map was generated to provide public information to visitors. The project recommends signage as a method to create awareness so visitors may avoid hazardous spots and notify them about what to do in an emergency. These products will help public visitors, researchers, ASCCA staff, and search and rescue crews to prepare before going into the hazardous areas; particularly those travelling alone. The hazard map may also help ASCCA managers indicate where to target efforts for future cellular relay devices.
Keywords: GIS; Spatial Analysis; DEM; Hazard Map; GeoApp; Terrain Model; Line of Sight
Supervisor: Lynn Moorman

Poster #1401, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Spatial Analysis of the Dispersal of Canada thistle (Cirsium arvense) onto the Ann and Sandy Cross Conservation Area
Authors: Kyrstin Stokes
Abstract

Invasive weeds and weed management is a regular topic of discussion at the Ann and Sandy Cross Conservation Area. Any areas of development or disturbance of soil surfaces poses a risk of weed growth. A spatial model was developed to identify areas of the Cross Conservation Area at high risk of invasion by Cirsium arvense based on; wind patterns, land cover, and slope aspect. Proposed management strategies of the invasive weed were directed at these high risk areas. Key data needed to identify areas at high risk of invasion of Cirsium arvense seeds by wind-distribution and to propose potential weed management strategies include; land cover (both vegetation and non-vegetative cover), digital elevation model (DEM), climate data, and historical air-photo imagery. This data was utilized to derive information on; healthy vegetation, areas of soil disturbances, seasonal historical wind patterns, and slope aspect. Providing the Ann and Sandy Cross Conservation Area with information on dispersal patterns of Cirsium arvense and attainable mitigation strategies which correlate with their 25 year adaptive management plan will allow for improved management and understanding of the species.
Keywords: GIS, Spatial Analysis, Cirsium arvense, Canada thistle, Ann & Sandy Cross Conservation Area
Supervisor: Lynn Moorman

Poster #1402, Presentation Time: 10:00 am - 12:00 pm
Abstract title: New Path Routing for the Ann and Sandy Cross Conservation Area
Authors: Riley Medd
Abstract
The Ann and Sandy Cross Conservation Area (ASCCA) is a 4800 acre natural area located just south west of Calgary, Alberta. The area is open to the public and is dedicated to protecting habitat for native species of wildlife. The ASCCA often hosts youth conservation education programs and closely manages the human use of the area in order to preserve its natural state. An important aspect of managing the human use within the area is maintaining the existing hiking trails and proposing new hiking trails when existing ones are damaged and are no longer safe for public use. With the use of a Geographic Information System (GIS), which is a system that allows you to store, manipulate, analyze and present spatial data, an alternative route to the damaged Fescue Trail at the ASCCA was proposed. The most practical route for this new trail was determined by conducting a number of analyses on an existing digital elevation model (DEM). The ASCCA had a number of criteria including, but not limited to, types of land cover, slope, proximity to existing infrastructure, and line of sight, that were incorporated into a least cost path (LCP) analysis. The result of this analysis was a trail extending from the ASCCA educational centre (Belvedere House) south past the education pond, with the final destination being located at the Rothney Reservoir. This information is intended to support the human use management of the ASCCA.
Keywords: Geography; Spatial Analysis; GIS; Conservation
Supervisor: Lynn Moorman
Poster #1403, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Detailed Study of Precambrian Massive Sulfide Mineralization, Karrat Group, Western Greenland and Sunset Lake, Northwest Territories
Authors: Cristian Otalora and Michelle DeWolfe
Abstract
The purpose of this project is to understand the sulfide mineralogy of Precambrian massive sulfide mineralization to characterize the mineral deposit type(s) and to better understand ancient ore-forming processes. The Karrat Group is a Paleoproterozoic (ca. 1.9 Ga) siliciclastic-carbonate-volcanic succession deposited uncomformably on top of Archean crystalline basement in Western Greenland. This area is comprised of five main lithological units metamorphosed and folded, along with the basement, during the Rinkian orogeny. The Sunset Lake area is located within the Archean (ca. 2.6 Ga) Beaulieu greenstone belt, Northwest Territories. Samples were collected from volcanic rocks of the Karrat Group and the Beaulieu volcanic belt during the 2016 field season for detailed mineralogy study

to determine if the type of mineralization is consistent with volcanogenic massive sulfide (VMS) type mineralization. Petrographic analyses were used to understand the composition of the host rock surrounding the sulfide mineralization, as well as to establish a general mineralogy. These analyses revealed sulfide mineralogy comprised of pyrite and pyrrhotite with minor galena, sphalerite, and chalcopyrite; all within a felsic volcanic host rock. This mineralization is consistent with VMS type mineralization, which is important because it is of a submarine volcanic environment, likely in an area of active rifting, which would account for the hydrothermal system responsible for such mineralization of volcanic rocks. Electron microprobe analyses will be used to understand detailed mineral chemistry, and to image zonation and growth patterns within the sulfide minerals thus helping to understand details of the mineralizing event(s).
Keywords: Sulfides; VMS; Precambrian; petrography; volcanism
Supervisor: Michelle DeWolfe

Poster #1404, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Mobile Data Collection App: Monitoring Anthropogenic and Natural Disturbances in Conservation Areas Using GIS
Authors: Stephanie Gruber
Abstract
Geographic Information Systems (GIS) can be used for many different disciplines including conservation. The Ann & Sandy Cross Conservation Area (ASCCA) aspires to conserve habitat for native species in southern Alberta. One of the many threats to conservation areas is disturbances to the native environment which includes anthropogenic and natural forces. Monitoring these disturbances is very important for conservation efforts as even the smallest disturbance can have a huge impact on the ecosystem. Currently, the staff at ASCCA do not have a way of identifying the locations of these disturbances in the field easily, nor do they have a repository means to store, display and analyze the data. The disturbance of most importance to ASCCA was soil disturbances as these would allow invasive species, or weeds, to take over that particular area. These disturbances could be due to towers, buildings, or pathways for example. Other disturbances that they wanted to map were evidence of fire, evidence of disease, as well as illegal poaching sites. The solution to their problem lied within the creation of an editable map and a field data collector. This would enable ASCCA to monitor these disturbances and give them the ability to update the data directly from the field. To help the ASCCA to display the disturbance history as well as current issues on the property a storymap was created. This storymap would enable spatial analysis which in turn could be used to assist in decision making and problem solving for ASCCA's conservation efforts
Keywords: GIS; Spatial Analysis; Conservation; Collector; Storymap
Supervisor: Lynn Moorman
Poster #1405, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: GIS Modelling of Landcover Change of the Ann and Sandy Cross Conservation Area
Authors: Anne Neumann
Abstract
The Ann and Sandy Cross Conservation Area (ASCCA) has been in operation since 1987 when 2000 acres was donated to the Province of Alberta. The land for the ASCCA originally began being purchased in 1945 and has undergone many changes since then. The ASCCA has been through fires, loss of the presence of beavers resulting in the loss of wetlands, and the introduction of non-native vegetation for ranching purposes. Present on the ASCCA landscape are spruce and aspen forests, non-native grasslands and native grassland vegetation. The ASCCA have expressed a goal of reintroducing more native grassland vegetation in their management plans.
Through analysis of the changing land cover using a Digital Elevation Model (DEM), spatial queries of

vegetation data and the analysis of historical orthophotos the landcover changes over time were identified. The change maps aided in identifying the loss in grassland areas of the ASCCA and in modelling of the soils data, areas most suitable for restoring native grassland vegetation were identified. The use of a Story-Map provides a technological solution for the ASCCA to use for educational purposes and to present to their board as well as an electronic database of historical orthophotos of the area.
Keywords: ASCCA; vegetation; grassland; orthophotos
Supervisor: Lynn Moorman

Poster #1406, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: GIS Spatial Analysis Approach for Carbon Sequestration on Grasslands and Forests at the Ann and Sandy Cross Conservation Area in Southern Calgary, Alberta
Authors: Stephany Villamil
Abstract
Carbon sequestration can reduce the entry of gas emissions into the atmosphere by using ecosystems to store carbon underground. Previous global, Californian and historical Albertan studies on carbon sequestration indicated that grasslands and forests both perform well as carbon sinks, yet grasslands are better carbon sinks for future investments within climate change environments in Alberta. GIS spatial analysis tools were able to assist the Ann and Sandy Cross Conservation Area's (ASCCA) interest of receiving funds provided by their natural ecosystems of grasslands and forests on the property. Previous work has failed to address specific carbon values in Calgary, Alberta, let alone Alberta for their forest and native grasslands and specific information on the method to achieve these values. By assimilating the findings of different sources, a method on grasslands and forests within ASCCA was used and represented by GIS spatial analysis to determine specific carbon values. The course community service-learning experience at Mount Royal University has allowed students to work alongside ASCCA in helping them get one step further of growing into the international model of sustainability and landscape management leader of protected areas they desire to be. This approach may assist in future investigations within carbon sequestration research and provide accumulated information from many previous studies to do so.
Keywords: carbon sequestration, carbon sinks, carbon value, sustainability, protected areas, GIS spatial analysis
Supervisor: Lynn Moorman

Poster #1407, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Developing a field application for mapping poisonous species in the ASSCA
Authors: Kelsey Brockbank
Abstract
In the Ann and Sandy Cross Conservation Area (ASCCA) there are poisonous plants which can cause death if consumed by wildlife, stock or humans. Presently, the area managers only know of three species that are poisonous but are unsure how many other poisonous vegetative species are on the property or where on the plants are located. To address their concerns, I researched and created a list of poisonous plants potentially on the property, and used ArcGIS to create an editable online map that is tied to a collector application for smart phones, with data fields appropriate to the ASSCA's needs. ASCCA staff can use this app to map locations of the poisonous plant species as they come across them in the field and then have an up-to-date map and database of species of concern. Besides recording the location of the poisonous species, the staff can use the collector app to photograph the plant, collect information on the user such as species type, data collector name, a description of the area, and the date. To enable further, analysis additional data layers may be added to the resulting map. The app functions without access to Wi-Fi, which will allow all staff to collect data anywhere on the property

and share it when they return to a Wi-Fi enabled area. A spatial web-based StoryMap was also created to display and enable exploration of the data and to also help inform area users and staff about the poisonous plants, and how to identify them.
Keywords: Poisonous Plants; Collector App, StoryMap, GIS
Supervisor: Lynn Moorman

Geology

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

Abstract title: Sulphur Isotope Geochemistry of the Mount Milligan Cu-Au Porphyry Deposit

Authors: Kate Nicas

Abstract

The 183 ±4 Ma Mount Milligan alkalic Cu-Au porphyry deposit is located in the Quesnel terrane in central British Columbia, Canada. This porphyry mineral deposit is associated with magmatic-hydrothermal ore forming processes and was emplaced at shallow levels in the Earth's crust. The Mount Milligan area contains Upper Triassic volcanic rocks of the Takla Group comprising island arc associated volcanic, pyroclastic and epiclastic rocks intercalated with subordinate sedimentary units. Fifty samples of pyrite and chalcopyrite from seven core samples that are representative of temporal and geographic mineralization atMount Milligan deposit were analysed in-situfor their sulphur isotope ($\delta^{34}S$) compositions by secondary ion mass spectrometry. Results from the sulphur isotope analyses are compared to published sulphur isotope ratios to determine: i) the origin of sulphur from hydrothermal fluids exsolved from magmas; ii) variance of fluid sources that precipitated magmatic-hydrothermalsulphide minerals in the system; and iii) the temperature of formation; all of which may help elucidate the nature of the ore-forming processes.

Keywords: Sulphur Isotope Geochemistry, Geology, Cu-Au Porphyry Deposit

Supervisor: Jeffrey Pollock

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

Abstract title: Unique and Destructive Deformation of a Blueschist pyllonite in North East Corsica Shear Zone

Authors: Dallan Beaudin

Abstract

Subduction is a destructive process that produces complex geology such as that of northern Corsica in the Mediterranean. Blueschist metamorphism occurs on the surface of the subducting slab preserving evidence of the high pressures experienced at depths of 15-30km, but relatively low temperatures of 200 to 500°C because rocks are poor conductors. Glaucophane and epidote in this rock preserve evidence of blueschist metamorphism. This rock is also a phyllonite. Based on stable mineral assemblage being quartz (32.5%), Ilmenite (20%), muscovite (32.5%), glaucophane (5%), epidote (Tr.), and albite (10%) the rock can be inferred to be a granodiorite protolith. Massive granodiorites (coarsely crystalline felsic rocks) in these conditions become phyllonites which are rich in phyllosilicates, cohesive and extensively ductilely deformed. Crystal-plastic deformation with secondary fracturing and cataclasitc flow deformation develops cleavage and schistosity fabrics that contain augens (eye-shaped minerals) and quartz banding. These deformation textures are commonly caused by extensive pressures which are evident of subduction or shear zones. In order to preserve the blueschist mineral assemblage, these rocks must have been exhumed rapidly by faulting in the accretionary wedge. The blueschist mineral assemblage becomes unstable at surface conditions, and thus a quick geological process, like faulting, is required. Small pockets of mafic material also help to preserve the blueschist minerals glaucophane and epidote minerals during exhumation.

Keywords: Corsica, shear zone,

Supervisor: Katherine Boggs

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

Abstract title: Petrologic analysis of fault-hosted sediment in the Middle Cambrian Burgess Shale—evidence for seafloor mud volcanism

Authors: Elyse Marzolf

Abstract

A large mudrock sample from a dike hosted in the Fossil Gully Fault on Mt Stephen, British Columbia was studied using petrographic thin sections and x-ray diffraction and microprobe analyses. The analyses revealed a composition of mostly aluminum phyllosilicate clay and magnesite, with lesser clinochlore, quartz, dolomite, calcite and pyrite, and minor iron oxides, rutile and apatite. This sample provides the first evidence of a significant magnesite occurrence associated with the Burgess Shale. The mineral assemblage is similar to that of the Baymag magnesite mine about 80 km to the SE, also of middle Cambrian age, and which occurs in a comparable structural setting on the Kicking Horse Rim (KHR). We propose that emplacement of the magnesite-rich assemblages in the two areas occurred as part of the same magnesian mineralization event in the middle Cambrian on the KHR. Major faults provided conduits for magnesium-charged mud and brine that, at times, vented onto the Cambrian seafloor as mud volcanism events and brine seeps. Fine-sand-sized, non-euhedral, quartz grains, some showing possible shear flow alignment, are widely disseminated in the mudrock sample and may represent grains from the underlying siliciclastic Gog and/or Miette groups that were entrained in the ascending mud and brines. Mud breccia and megascopic roll-over structures in the sample further support a mud volcano/dike origin for the sample. Mud volcanism provides a suitable mechanism for exceptional preservation of the Burgess Shale fossil assemblages through low energy, rapid burial in mud slurries.

Keywords: mud volcanism; Burgess Shale; dike; clinochlore; magnesite

Supervisor: Paul Johnston

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

Abstract title: The Complex Relationship Between Proterozoic Metamorphic Events of the Colorado Rockies

Authors: Adam Gutsche

Abstract

The complex relationship between mountain building during the Yavapai Orogeny (at ~1.76 billion years ago or Ga) and intrusions of large hot magma bodies (~1.7 and 1.4 Ga) makes it very difficult to unravel the metamorphic history of the Colorado Rockies. Sample 2019-G was collected from the Big Thompson Canyon (BTC) which is one of the few areas in Colorado where it is possible to trace out the sequence of mappable metamorphic minerals. The region hosts two large igneous intrusions – the Paleoproterozoic Routte Suite (~1.7 Ga) and the Mesoproterozoic Berthound Suite (~1.4 Ga). Deformation events in the BTC are thought to be restricted to the mountain building events within the Paleoproterozoic Yavapai Orogeny (1.76 - 1.70 Ga). Timing of the orogeny and magmatic intrusions implies that metamorphism started ~ 1.76 Ga, with the onset of the Yavapai Orogeny. This initial regional metamorphism was later overprinted by contact metamorphism associated with the intrusions of the Routte and Berthound Suites. Sample 2019-G contains the mineral assemblage muscovite + staurolite + biotite + garnet + alkali-feldspar. The presence of metamorphic alkali-feldspar suggests that the region underwent peak metamorphic conditions associated with the granulite facies (temperatures of 600-700°C and pressures of 0.2-0.4 GPa based on the muscovite to alkali feldspar phase diagram). Further work is necessary in the Big Thompson Canyon region to constrain the nature of both the regional metamorphosis related to the Yavapai Orogeny and the contact metamorphic overprint related to intrusion of the Routte and Berthound Suites.

Keywords: Proterozoic; Metamorphism; Granulite; Petrology

Supervisor: Katherine Boggs

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

Abstract title: Slippery schists - Unlocking metamorphic processes of mountain building in the Canadian Cordillera

Authors: Ryley Penner

Abstract

The Canadian Cordillera (mountains west of Calgary) is a complex mountainous system due to two episodes of deformation caused by two separate collisions at 190 and 140 Ma (million years ago) followed by extension around 60 Ma. This final extensional pulse emphasized the expression of the RMT (Rocky Mountain Trench); a 1700km long feature visible from space that extends from Idaho across British Columbia into the Yukon Territories. Metamorphic features such as textures and minerals provide a window into the mountain forming process. Sample 2019T is a muscovite + biotite + garnet + staurolite schist from beside the RMT north of Golden, British Columbia. The most prominent metamorphic fabric in this rock is likely related to the 140Ma compression; while between these foliation planes small folded portions likely represent the previous 190Ma compression. The presence of staurolite implies that this sample experienced staurolite zone metamorphism in the amphibolite facies. The conditions that are constrained by staurolite and amphibolite facies are temperatures of 500°C to 700°C, pressures of 0.2GPa to 1.0Gpa, and depths of 10km to 40km. Staurolite zone metamorphism is typical of the large scale regional metamorphism experienced during mountain building, a setting known today as the Barrovian zones first outlined by Barrow in the Scottish Highlands. Today, this Barrovian regional metamorphism is observed across our planet such as in the Scottish Highlands and the Colorado Rockies.

Keywords: Geology; metamorphic petrology; mountains; rocks

Supervisor: Katherine Boggs

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

Abstract title: The East Tenda Massif sericite-epidote meta-granite

Authors: Carissa Schmidtke

Abstract

Mountain building is a very destructive process that creates gorgeous textures such as C and S fabrics in shear zones, such as the Tenda Shear Zone on the eastern margin of the Tenda Massif on Corsica, in the Mediterranean. The Tenda Massif is the Hercynian aged basement, that developed during a span of time extending from 370 million to 290 million years ago. During this collision the granitic basement of the Tenda Massif deformed under greenschist metamorphic conditions (temperatures of 300–450 °C and pressures of ~2-10 kilo bars). Overthrusting of the blueschist facies (temperatures of 100-500°C and pressures of ~4-16 kilo bars) schistes lustre thrust sheet created the Tenda Shear Zone with increasing deformation upwards towards the thrust sheet. Late syn-orogenic extension uplifted the exposed Tenda Shear Zone to the surface. The mylonitized sample 2019Z has a schistosity (S) fabric parallel to the shear direction and a cleavage (C) fabric perpendicular to the main stresses in the system. The modal mineralogy of rock sample Z consists of, 25% quartz, 20% potassic feldspar, 45% plagioclase feldspar. Thus, identifying the original composition of the Tenda Massif as a granite. After metamorphism, this rock became a sericite-epidote meta-granite. The majority of the plagioclase crystals are only preserved as relict crystal outlines due to complete replacement by 3% epidote and 45% sericite causing alteration by the presence of fluids during deformation and uplift.

Keywords: East Tenda Shear Zone; Corsica; Meta-granite; Metamorphism

Supervisor: Katherine Boggs

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

Abstract title: Crustal Deformation: The Story of the Epidote-Graphite Calc-Silicate

Authors: Amira Taha

Abstract

Compositional layering of quartz and calcite suggest that this rock belongs to the top layer of an ophiolite sequence (slice through oceanic crust and underlying mantle) on Corsica in the Mediterranean. The presence of graphite throughout the sample suggests that there was an organic carbon compound in the depositional environment of the sediment. The long axes of graphite and quartz rods define foliation and folding. These metamorphic fabrics were formed during the Alpine Orogeny (mountain building cycle) which consisted of two main compressional phases. The first consisted of continental collisions, which can be interpreted as the source of the foliation within this sample. The final phase involved intra-oceanic subduction, which resulted in the folding evident throughout this rock. Epidote in this sample likely formed due to circulating fluids during elevated temperatures due to this deformation. Even though the sample experienced significant recrystallization, the compositional layers preserve evidence of original bedding.

Keywords: Corsica, Calc-silicate, ophiolite, continental collisions, intra-oceanic subduction

Supervisor: Katherine Boggs

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

Abstract title: Coexistence of Glaucophane-bearing Blueschist and Eclogite of Rock Sample from Corsica, France Gives Key Evidence Towards Tectonic History

Authors: Cassidy Kitchen

Abstract

It is very unusual to find rocks with layers of blueschist and eclogite mineral assemblages because these mineral assemblages are not usually stable in both the blueschist and ecologite ranges of pressures and temperatures. Sample 2019B from Corsica in the Mediterranean, has layers with green omphacite and red garnet (eclogite) as well as layers with blue glaucophane and epidote (blueschist). Brovarone et al (2011) analyzed the chemistry of these rocks and determined that these different lithologies formed at the same temperature and pressure (520 +/- 20°C and 2.3 +/- 0.1 GPa), which is typically associated with the eclogite facies. In order to equilibrate the "blueschist" and "eclogite" mineral assemblage layers within this sample, there has to be significant differences in water and calcium content between the distinct layers. The calcium-rich layers favor the "eclogite" facies; while the calcium-poor layers favor the "blueschist" facies. This is due to the fact that the calcium atom can fit into the omphacite crystal while the calcium atom does not fit into the glaucophane crystal. These compositional layers are also folded, which likely occurred during the Alpine Orogeny where the European continental margin was subducted under the oceanic sediment of the Adriatic plate. Blueschist metamorphism is associated with these subduction zones.

Keywords: Lithologies; Alpine Orogeny

Supervisor: Katherine Boggs

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

Abstract title: Serpentine: The Wet Conveyor Belt at Convergent Margins

Authors: Emily MacMillan

Abstract

Serpentinization is a result of low to high grade metamorphism through hydration of ultramafic rocks such as peridotites. Serpentine subgroups can contain up to 13% wt% H2O and can be subdivided into chrysotile, lizardorite, and antigorite varieties with a chemical formula Mg6Si4O10(OH)2. Serpentinization is common in ophiolite series at convergent margins, when slices of oceanic crust and upper mantel material are uplifted over continental crust. Ophiolite emplacement is very dynamic causing the formation of internally mixed rocks within a deformed matrix, also known as a mélange.

Serpentinization can alter deep ocean floor rocks at convergent boundaries (abyssal serpentine), within the accretionary wedge (wedge serpentine), or on the subducting slab beneath the wedge (subduction serpentine), creating a continuum of serpentinization as well as metamorphism to form other minerals like brucite, talc, secondary olivine, and secondary pyroxene. Sample 2019H was collected from the Ring Mountain region in California and consists of serpentine (60%), talc (40%), and minor forsterite (trace) with opaques (trace)x- thought to be magnetite and hematite. This mineral assemblage suggests peak metamorphism occurred around ~450°C - 600°C and 0.5kbar - 9kbar implying sample 2019 formed beneath the accretionary wedge on the subducting slab.
Keywords: Serpentine, Talc, Subduction Zone, Metamorphism
Supervisor: Katherine Boggs

Poster #1509, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Snakes on a (Fault) Plane
Authors: Natasha Campbell
Abstract
Subduction forms mélanges (French word for mixing) which are messy rocks composed of pieces of many rocks in the vicinity of the subducting slab. The Franciscan Complex of California is the type locality for both blueschist metamorphism and mélanges that form on the subducting slab. Subduction started 165 Ma (million years ago) and continued for 140 million years until 25 Ma. A sandstone olistostrome (a sedimentary deposit composed of a chaotic mass of heterogeneous material like blocks and mud) was collected from the Skaggs Road quarry near Lake Sonoma, California. This pale grey sample is soft and friable, composed of fragments of mud and serpentine which would classify this material as a lithic wacke with serpentine clasts (1mm in diameter) and chert nodules (4mm diameter). While the matrix of the sample is not foliated, many of these fragments are foliated. This variation in lithologies and fabrics demonstrates the diverse nature of these mélanges. This mélange is predominantly 20% diopside, 15% orthopyroxene and 10% olivine with almost everything found in this sample being serpentinized. Serpentine forms between 250°C to 900°C with three different variations (lizardite, chrysotile, and antigorite) antigorite is the dominant serpentine in this sample. The presence of serpentinite and the sandstone olistostrome classification of this sample suggest that diapirism through a serpentinized peridotite, likely the mantle layer of an ophiolite complex (oceanic crust), emplaced this rock near the surface.
Keywords: serpentine; subduction; peridotite; melange
Supervisor: Katherine Boggs

Poster #1510, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Dueling Deltas: Comparative Analysis of the Beaufort Mackenzie Basin and Tertiary Niger Delta
Authors: Cylenna Alexander
Abstract
What links the Mackenzie delta in the Canadian Arctic to the Niger delta over 11,300km away along the Gulf of Guinea? Since 1956 petroleum resource exploitation resulted in significant environmental degradation across the Niger delta with negative socio-economic consequences. These impacts are heightened for the generally subsistent Nigerian population who rely heavily on the environment for their livelihood. Exploration for petroleum started across the Mackenzie delta in the early 1970s resulting in resource estimates of ~1.16 x 10^9 barrels of oil and 8.99 trillion cubic feet (tcf) of gas. These petroleum resources are hosted in Lower Cretaceous (100-146 Ma; million years ago) and Tertiary (2- 65 Ma) reservoirs located in the Mesozoic (66-25 Ma) rifted continental margin that underlies the Mackenzie Delta which opened the space for sediments to accumulate and host this petroleum system. While there has been a moratorium on development of these resources in the Mackenzie delta, attention is now returning as this moratorium on drilling will be reviewed in 2021.

Additionally, the summer of 2018 marked the first time that tourists were able to drive all the way from Inuvik to Tuktoyaktuk along the new extension of the Dempster highway during the summer. The local Innuvialuit communities depend on their local environment for their livelihoods; just as do the local people of the Niger delta. This study uses historical data from the Niger delta to identify high level considerations for socially and environmentally responsible oil and gas (and tourism) development in the Beaufort Mackenzie region
Keywords: geology; environment; socioeconomic; petroleum
Supervisor: Katherine Boggs

Poster #1511, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Understanding the Emplacement of Messy Melanges
Authors: Jacob Lucyshyn
Abstract
Melanges are massive messy rocks that are created by the subduction of the Pacific plate underneath the North American plate in California. This is where Franciscan metamorphism was first described with its classic blueschist metamorphic rocks (that form on the subducting slab) and melanges. Sample 2019Y is composed of one large clast of serpentine in a serpentine-rich matrix and a serpentine-brucite shear zone; and it was itself a clast within a larger outcrop. Multi-lithological clasts are typical in these melanges as are small shear zones due to the deformation involved when forming melanges. Serpentine forms due to ocean floor metamorphism of mafic and ultramafic rocks; starting at temperatures of 100^0C with the growth chrysotile and lizardite. The transition to lizardite and antigorite occurs from 300-400^0C, which then processes to only antigorite up to 450^0C where brucite starts to form. The presence of brucite in the shear zone suggests elevated temperatures caused by the deformation stresses necessary to form the shear zone. In this zone the minerals are heavily fractured and brucite is well-formed. The groundmass shows mild foliation perpendicular to stress plane with minimal foliation displayed inside the clast. The lack of abundant brucite in the groundmass and clast of sample 2019Y is a key indicator that outside the shear zone the rock did not reach temperatures $\geq 450^0$C. Comparing these parameters to metamorphic mineral assemblage facies, a peak mineral assemblage can be inferred somewhere in the late green/blueschist facies, although the key minerals have been destroyed or pseudomorphed.
Keywords: Serpentine; Metamorphism; California; Melange; Subduction Zone
Supervisor: Katherine Boggs

Poster #1512, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Controls on Water Quantity and Quality in the Shingle Spit-Phipps Point area, Hornby Island, British Columbia
Authors: Gareth Williams
Abstract
Hornby Island is situated in the Salish Sea, 25kms southeast of Comox, off the east coast of Vancouver Island. The island is relatively small with an area of $30km^2$ and a maximum elevation of 330m. The geology of Hornby consists of over 2km of Upper Cretaceous strata which display a gentle dip to the northeast and are comprised of five formations (DeCourcy, Northumberland, Geoffrey, Spray and Gabriola) within the upper section of the Nanaimo Group. With a population of around 1,000 people, almost all relying on groundwater to supply their basic living needs, understanding the controls on the quantity and quality of groundwater is of great importance. Based on previous studies completed on different areas of the island, it is believed that groundwater movement occurs through fractured rock and along bedding planes and fault zones. This study uses lithology information from water wells to construct geology cross-sections which demonstrate the controls on water quantity in the Shingle Spit-Phipps Point area, on the western side of the island. Water quality issues in the same area were

examined by considering recently collected well data which showed dramatic variations in pH (6.5 to 9.5) within this small part of the island. Groundwater ion exchange within the fractured shales of the Northumberland Formation is considered the most likely explanation of this large range in values.
Keywords: hydrogeology; groundwater; water chemistry
Supervisor: John Cox

Poster #1513, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Lithostratigraphy of the Sunset Rhyolite, Beaulieu Volcanic Belt, Slave Province
Authors: Shelby Austin-Fafard and Michelle DeWolfe
Abstract
The Sunset Lake area is composed of Neoarchean (ca. 2.6 Ga) volcanic rocks of the Beaulieu greenstone belt. The study area is located roughly 100 km east-northeast of Yellowknife. The focus of the project is to study the petrogenesis and environment of deposition of the volcanic rocks along the south part of Sunset Lake. Detailed bedrock mapping, field and petrographic descriptions were done to understand the origin and evolution of the volcanic rocks, as well as to determine the environment in which the rocks were erupted/deposited. The lithologies from oldest to youngest are: 1) massive to pillowed basaltic to andesitic flows (>200 m); 2) coherent, aphyric to porphyritic, massive rhyolite flows with local lobes and in-situ breccia (25-100 m); 3) heterolithic volcaniclastic rocks consisting of mafic and felsic clasts (50-100 m); and 4) felsic volcaniclastic rocks with similar average composition to the coherent rhyolite (50-100 m). These rocks have experienced several episodes of deformation and metamorphism resulting in greenschist to amphibolite facies metamorphism. Preliminary interpretations suggest the volcanic rocks were erupted subaqueously, confirmed by the presence of hyaloclastite, volcanic glass formed by quench fragmentation. Features observed in the field such as flow top breccias, normal graded bedding and contact relationships between lithological units suggest the volcanic sequence represents a continuous homoclinal sequence and is not folded about a north trending, isoclinal fold as was previously interpreted. This has economic implications as a Cu-Zn deposit to the north is hosted by this volcanic sequence.
Keywords: Lithostratigraphy; volcanic rocks; subaqueiusly;
Supervisor: Michelle DeWolfe

Poster #1514, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Geologic features on the surface of Venus
Authors: Nkenjika Ngini
Abstract
Venus is a planet similar both in size and mass to Earth, however Venus is uninhabitable. The surface of Venus is characterized by features such as calderas, coronae, lava flows, ridges and troughs. Other features include impact craters and highlands. These features provide an analogue for early conditions on Earth. The Magellan was launched on May 4, 1989, with the goal of mapping the entire surface of Venus. Altimetry, radiometry data and electrical properties were used to measure surface topography. The Magellan mission used its first 8 months to collect radar images of about 84% of the planet's surface. After 2 more mapping cycles, data images collected amounted to about 98% of the planet's surface. Data was collected from the USGS mapaplanet2 site from the eastern side of the V58 or Henie quadrant to determine the cross-cutting relationships between features.
From the Henie quadrant, the section of the quadrant that is being mapped has shown evidence of a caldera, ridges and a single episode of a dyke swarms that stretches across most of the mapped from the east to the west. The caldera is relatively minor and is in the south eastern part of the mapped area.
Keywords: Venus; Henie; Caldera; Dike Swarm
Supervisor: Katherine Boggs

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

Abstract title: metamorphic petrology of an Ultra-High Temperature (UHT) granulite rock

Authors: Muhammad Azlan

Abstract

Blue minerals are relatively rare; blue sappharine (not the gem) plus quartz indicates that the rock was once in ultra-high temperature conditions with temperatures in excess of 900 °C at depths between 20 and 40 km. In the billion years since the Grenvillian Orogeny (mountain building), nearly 30 km of rock has been eroded off the surface across large portions of the Grenville Province of the Canadian Shield, which permits rocks such as Sample 2019U to be exposed at the surface. Rocks that form near the base of the crust (such as 40km beneath our feet in Calgary) are called granulites. Typically, it is the combination of metamorphic orthopyroxene and clinopyroxene that define granulites. This sample has an abundance of clinopyroxene (26%) and orthopyroxene (25%), however in this case the sapphirine and quartz indicate this rock is a granulite, since sapparine is only formed under very high temperatures. As these rocks come to the surface, they experience decompression (decreases in pressure) that frequently form intricate symplectite textures. Metamorphic symplectites form during decompression; the release of pressure associated with the exhumation of these rocks to the surface. These symplectites look like intertwined worms of different minerals; in this case sappharine, quartz and spinel.

Keywords: granulite; rock; UHT; metamorphic; tectonic

Supervisor: Katherine Boggs

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

Abstract title: Corsican Serpentinite

Authors: Inam Jamil

Abstract

Slices through the oceanic crust (ophiolites) are preserved on Corsica in the Mediterranean. Such exposure on the surface is rare because oceanic crust is denser than continental crust and is therefore usually subducted. Corsican ophiolites formed during the Alpine Orogeny (mountain building) when the European continental plate was subducted under the Adriatic plate. This sample contains serpentine, olivine, clinopyroxene (CPX), orthopyroxene (OPX), brucite, and magnetite. Serpentinization of olivine, CPX and OPX occur in hydrous conditions at temperatures approximately above 250C. Magnetite forms during serpentinization because the iron cannot be taken into serpentine. Brucite is aligned in a small shear zone which formed during the emplacement of these ophiolites at temperatures of between 250C and 400C, with pressures between 0.2GPa and 0.4GPa. Serpentine forming reaction curves are steep on pressure-temperature graphs which implies that these reactions are not helpful for constraining pressures of formation. Therefore, to further constrain the metamorphic conditions for Corsica, it would be necessary to examine other rock samples. However, the lack of felsic minerals in this sample support the conclusion that this sample had an ultramafic protolith (parent material) that likely came from the bottom/mantle layer of the Corsican ophiolite.

Keywords: Corsica; Serpentinite; Alpine Orogeny; Metamorphism

Supervisor: Katherine Boggs

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

Abstract title: Multilayered Coronitic Metagabbro

Authors: Nicole Boulton

Abstract

Beautiful coronas provide evidence that this coronitic metagabbro was once at the bottom of the crust roughly 40km beneath our feet here in Calgary. This metagabbro experienced three reactions creating coronas that encase pyroxene during the voyage to the surface. Pyroxenes support that this rock

experienced granulite metamorphism at a range of 1.1-1.3 GPa and 800-900 °C during the Grenville Orogeny (mountain building) between 1.5 and 1.0 billion years ago. The coronitc texture provides a thorough reconstruction of the rocks P-T history, only after temperatures of 1000 - 700 °C and pressures of 1.1-0.45 GPa do the coronas begin to form indicating retrogression. An initial dry granulite facies environment is suggested due to the ameboidal shaped coronas and either clinopyroxene or orthopyroxene at their core. The next layer of the coronae was formed during uplift into the presence of circulating fluids forming the hydrous hornblende. Wormy intergrowths of minerals that formed during decompression (decrease in pressure) as the rock rose are known as symplectites, hornblende + quartz + spinel symplectites formed next. Garnet forms the final layer that mantles these coronas, this represents amphibolite grade metamorphism with the adjacent hornblende at temperatures ranging from 850-650°C and pressures ranging from 1.0–0.6 GPa. Overall in these coronae the internal orthopyroxene + clinopyroxene represent granulite facies at the bottom of the crust where the gabbro crystallized; while the outer garnet + hornblende represents the rise of this gabbroic body into the mid-crustal region typical of amphibolite metamorphic facies.
Keywords: Corona; Metagabbro; Grenville; symplectites
Supervisor: Katherine Boggs

Poster #1518, Presentation Time: 10:00 am - 12:00 pm
Abstract title: North Carolina Eclogites
Authors: Devon Brown
Abstract
"Christmas tree" eclogites from Blue River, North Carolina, provide windows into processes in the deep crust and mantle of our planet. Eclogites form at the base of the Earth's crust, at about 40km beneath our feet here in Calgary. The mineral assemblage of green omphacite (a clinopyroxene) and red garnet is typical of these "Christmas tree" rocks which are relatively rare because these minerals are not stable at the Earth's surface. In North Carolina, eclogites are contained within small blocks that were brought to the surface during by tectonic processes. These eclogites are classified as group B eclogites, they contain 30-50% garnet with about 15% hornblende amphiboles, which show evidence of retrograde metamorphism. The protolith (parent material) for this eclogite group type would be intermediate, between an olivine and tholeitic basalt, which would result in higher Ca/Mg ratios then other eclogite groups. One possible reaction to form eclogite facies assemblages is by the breakdown of glaucophane + paragonite to form garnet + pyroxene. Unlike the Corsican eclogites from the Mediterranean, Blue River eclogites have depletion haloes around garnets composed of quartz and feldspars where iron and magnesium were sucked out of the surrounding region to form the iron-magnesium-rich garnet.
Keywords: eclogite, geology, tectonics, Omphacite, Garnet, North Carolina,
Supervisor: Katherine Boggs
Poster #1519, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: CO_2 sequestration in subsurface Alberta brine—potential geologic mitigation of greenhouse gas emissions
Authors: Mathieu Boudreau, Paul A. Johnston, Francois Marechal, Jennifer J. Scott and Daniel T. Chupik
Abstract
Carbon dioxide capture and sequestration (CCS) reduces the effect of greenhouse gas emissions by storing large volumes of carbon dioxide (CO_2) underground. Geologic CCS projects store CO_2 in deep saline waters (brines) deemed not to be of economic value, such as saline water zones found in the subsurface of Alberta. We are investigating the Upper Devonian (Famennian) Stettler Formation, part of a large hypersaline carbonate platform, to develop a model for brine-related CCS projects in Alberta. Well-log data and geochemical (XRF, SEM-EDS), mineralogic (XRD, Raman) and

petrographic analyses of drill cuttings from previous exploration wells in our study area were used for correlating and characterizing zones within the formation. The primary lithology of the formation is anhydrite ($CaSO_4$) and dolomite ($CaMg(CO_3)_2$) with lesser halite (NaCl), distributed mainly in specific horizons from the studied wells. A Lower Saline unit was identified and mapped using well-logs and is associated with increased halite identified in drill cuttings. Halite cuttings also display inclusions of metals, which may indicate that metal ions were in solution in the depositional environment and potentially concentrated in the saline zones. Evidence for later fluid migration includes injected bitumen and signs of hydrothermal alteration identified throughout the formation. To further investigate the feasibility of a potential CCS project, we are now testing our depositional model by expanding our study to a near-by and similar basin and investigating the timing and processes related to post-depositional fluid migration that may be significant in resolving concerns about CO_2 leakage back to the atmosphere.
Keywords: carbon dioxide; sequestration; greenhouse gas; mitigation; Stettler Formation
Supervisor: Jennifer Scott

Poster #1520, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Serpentinized Melanges of the Franciscan Complex
Authors: Matt Finnegan
Abstract
Mixing during active subduction at a continental – oceanic margin forms tectonic mélanges (French word for mixing). Subduction channels are theoretical zones in the deep subduction margin where much of this mixing occurs. Off-scraping, underplating and tectonic slicing results in the integration of multiple lithologies in these mélanges. Sample 2019V is composed of 65% serpentine and <1% clinopyroxene. Serpentine forms by hydration of clinopyroxene at a temperature between 100 and 400C; and up to depths of 60km. The reaction curves in pressure-temperature graphs for ultramafic metamorphism involving serpentinization is extremely steep and are therefore not helpful for limiting pressure of formation. The abundance of clasts and other broken remnants imply a high strain (shear zone) environment for the rock. California's subduction zone provides excellent evidence for the formation of mélanges and seafloor metamorphism. Sample 2019V being a serpentinized mélange it fits well into the geologic setting of the Franciscan belt.
Keywords: geology; metamorphic petrology; franciscan complex; serpentine; subduction zone
Supervisor: Katherine Boggs

Poster #1521, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Problematic agglutinated tubes from the Late Cretaceous Bearpaw Formation, Alberta
Authors: Virginia Gold and Paul Johnston
Abstract
Rock samples collected from a muddy fine-sandstone unit in the upper part of the Late Cretaceous Bearpaw Formation, near East Coulee, Alberta, have yielded abundant tubular fossils of uncertain origin. Petrographic and hand sample study reveals the fossils are simple straight tubes that show little size variation. The tubes are open at both ends, are typically about 3.0-4.0 centimetres long, 0.5-1.0 centimetres wide, and show no obvious tapering. They are constructed of sub-millimetric transverse clay-rich and sand-rich bands. A thin clay layer appears to line the tube interior. In thin section, cement is not detectable between the sand grains, which instead appear to have been agglutinated with clay. Associated with the tubes are naticid and high-spired gastropods, marine bivalves, and rare fish bones, intraformational pebbles, and massive to planar laminated fine muddy sand with locally developed cross-stratification, all indicative of intertidal to shallow subtidal deposition. The sand grains and clay comprising the tubes match in size and composition the host matrix, indicating the tubes are likely autochthonous rather than being transported from elsewhere. Morphologically and

compositionally, the tubes seem most similar to agglutinated tubes constructed by various terebellid polychaete worms, notably the Pectinariidae. Another possibility are agglutinated caddisfly casings (Trichoptera), which, although mostly freshwater, are known from some modern intertidal settings. A difficulty with these interpretations is that both the pectinariid worms and the caddisflies construct fragile tubes, typically only one sand grain thick, whereas the Cretaceous examples are much more robust.
Keywords: Tubes; Polychaete Worms; Caddisfly Casings; Bearpaw Formation; Intertidal; Cretaceous
Supervisor: Paul Johnston

Poster #1522, Presentation Time: 10:00 am - 12:00 pm
Abstract title: The strain of building a mountain: an analysis of amphibolite facies schist from the Rocky Mountain Trench
Authors: James Climie
Abstract
Mountain building is a very complex and messy process that involves deformation, metamorphism, alteration and eventual erosion. The Canadian Cordillera is particularly complex with two significant collisions that created two separate subduction zones at ~190 Ma (million years ago) and ~140 Ma followed by extensional collapse at ~60Ma. Sample 2019M was collected from beside the Rocky Mountain Trench (RMT) north of Golden, British Columbia. The RMT is a feature whose expression was emphasized by the last gasp of extension and extends over 1700km from Idaho north across British Columbia into the Yukon Territories. The sample is composed of garnet (10%) + muscovite (35%) + biotite (20%) + quartz (10%), + staurolite (10%),+ kyanite (5%), + chlorite (5%); with trace apatite, potassium feldspar, and ilmenite. The peak mineral assemblage of staurolite + kyanite places this rock in the kyanite zone of amphibolite facies representing 500 to 700°C, and 0.6 to 1.2GPa. This corresponds to a depth of between 20 and 40km depth in the mid crustal region of the Earth's crust. Strong foliation in this sample defined by aligned muscovite and biotite and a quartz band was formed during one of the two collisional events that formed the Cordilleran Mountains. Chloritization occurred due to fluid circulation as these mid crustal regions were brought to the surface during the last period of extension.
Keywords: metamorphic; schist; amphibolite; Cordillera
Supervisor: Katherine Boggs

Poster #1523, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: Greenschist Skarn
Authors: Taylor Wasuita
Abstract
Skarn deposits have potential to contain economically important minerals due to alteration by hydrothermal fluids that could concentrate and deposit valuable minerals. Sample KB7079D is a calcite (30%) + biotite (25%) + Tremolite (10%) + plagioclase (15%) + quartz (10%) skarn; which is a mix of silicate (biotite, tremolite, plagioclase, quartz) and carbonate (calcite minerals). This mix of minerals indicates that the parental material before metamorphism was a calc-silicate. It is frequently necessary to examine other lithologies for evidence of metamorphism because the carbonate prevents the growth of many metamorphic indicator minerals such as kyanite or sillimanite. The long axes of biotite define a weak foliation in this sample typical of the regional metamorphism typical of the mountain forming process known as orogenesis. While this biotite in pelitic rocks would indicate biotite zone metamorphosis in the greenschist facies; it is highly likely that this rock experienced temperatures greater then 400°C and pressures greater then 0.5 Gpa. Typically the greenschist facies rocks are altered between 250°C - 400°C and pressures of between 0.3GPa-0.5GPa. This sample came from beside the Rocky Mountain Trench (RMT), which is a 1700km long feature visible from space that extends from Idaho north through British Columbia into the Yukon. This feature was emphasized

by the last gasp of extension related to the Cordilleran Orogeny that formed the mountains that surrounds the RMT. The foliation in sample KB7079D would have been formed during this orogeny and would have been oriented north-northwest parallel to the length of the RMT.
Keywords: Skarn, Minerals, The Rocky Mountain Trench, Greenschist
Supervisor: Katherine Boggs

Poster #1524, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Case of Aggravated Basalt on the Shores of Lake Superior: Zeolite Facies Metamorphism of Michigan
Authors: Alen Poskovic
Abstract
Over a billion years ago, before the Grenville collided with the Superior Province of the Canadian Shield, the Mid Continental Rift (MCR) was being formed as North America was being torn apart. Sample 2019D was a boulder collected from the southwest shores of the Great Lake Superior, which was formed in the time of the formation of the MCR. Basalts such as this sample were extruded into this rift valley. This sample now has a mineral assemblage of Plagioclase (40%), Rutile (20%), Clinopyroxene (10%), Calcite (10%), and Zeolites (~5%; Analcime, Laumontite, and Wairakite). These three Zeolite minerals exhibit low to medium relief. Another key distinguishing feature of the Zeolite minerals is that they all share being optically biaxial negative. This rock shows a vesicular texture, this is a textural term that refers to the voids observed in an igneous rock. These voids are formed by the quick cooling on the surface of the Earth, before the gases can escape. These vesicles in the Basalt are observed to be filled in with Calcite and Zeolite minerals. The fragile radiating habit of the Zeolites and the preserved vesicles indicate that this rock did not experience Zeolite facies metamorphism at 100 - 200°C and 0 – 0.6 GPa at low depths. White Zeolite facies metamorphism is the lowest grade metamorphic facies; evidence of this metamorphic facies is rare because the reactions to form these Zeolites requires the presences of significant amounts of fluid.
Keywords: Geology; Metamorphic Petrology; Zeolite Facies; Great Lake Superior; Mid Continental Rift
Supervisor: Katherine Boggs

Poster #1525, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: What can a Meta-Gabbro Reveal about the History of the Grenville Orogenic Belt?
Authors: Samantha Warren
Abstract
Mid to deep crustal rocks are exposed today at the surface after one billion years of erosion across the western Grenville of Ontario and Quebec. Some studies have been done in the area to determine the order and degree of metamorphism. Petrographic analysis revealed the process of metamorphism experienced by rocks. Sample 2019S is a meta-gabbro with garnet, clinopyroxene and hornblende which suggests amphibolite facies that formed between 0.2-1.0 GPa and 500-700C. Some porphyroblasts of garnet and clinopyroxene show skeletal texture with exsolution lamellae of quartz and clinopyroxene. The quartz and feldspar porphyroblasts can be described as granoblastic polygonal with crystals that are roughly the same size and equidimensional. There are many features of the original minerals in this rock, the cleavage of clinopyroxene can be seen in most porphyroblasts. Sample 2019S contains prograde hornblende and opaque minerals with partial depletion halos of quartz and feldspar around the porphyroblasts, grown at the same time that the minerals formed. The depletion halos contain quartz and feldspars. Using this information sample 2019S can be placed in the Mooroton shear zone of the Grenville orogenic belt. This demonstrates that careful petrographic analysis of metamorphic rocks can reveal important information about the tectonic history of regions such as the Grenville.

Keywords: Meta-Gabbro; Grenville; Amphibolite Facies; Metamorphism; Depletion Halos
Supervisor: Katherine Boggs

Poster #1526, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Biomarker Geochemistry as a Reservoir Surveillance Tool – Long Lake, AB
Authors: Mitchell Gillrie
Abstract
The Athabasca Oilsands in Alberta, Canada are one of the largest oil reserves in the world with nearly 170 billion barrels of recoverable oil primarily from the McMurray Formation. Oil is produced by Steam Assisted Gravity Drainage (SAGD) in these world class reservoirs which are accurately monitored with observation wells and 4D seismic. This study focuses on biomarker geochemistry as another tool in reservoir surveillance. The process and methodologies of using biomarker geochemistry as a surveillance tool for SAGD developments revolve around the concept of biodegradation. Degradation is driven by proximity to water sources due to higher microbial concentration. The changes in concentration within the oil column allow identification of diffusivity baffles, obstacles, and barriers as well as the stratigraphic location from which produced oil drained. From this concept, three methodologies were created to determine the stratigraphic location of the produced oil: 1-Concentration Sums (in Excel), 2-Compound Values (in Spotfire), 3-Chromatograms (in Malcolm). Multiple bitumen samples are extracted from cored delineation wells at strategic intervals and analyzed using gas chromatography – mass spectrometry (GC-MS). In combination with produced oil samples taken from the field, concentration and chromatogram data are used to assign produced oil samples stratigraphically to elevations from the cored bitumen samples. These interpretations have been supported by both observation wells and 4D seismic. The study will explain processes of using biomarker geochemistry as a surveillance tool.
Keywords: Geology;Geochemisty;Biomarker;CNOOC;Oilsands
Supervisor: John Cox

Poster #1527, Presentation Time: 2:00 pm - 4:00 pm
Abstract title: High-grade, boron bearing metamorphism of the Grenville Province
Authors: Conor Newton
Abstract
Rare boron-bearing minerals found in gneissic rocks of the Grenville orogenic belt provide insight into the behaviour of boron-rich materials under granulite facies conditions that occur at the bottom of the crust 40 km beneath out feet in Calgary. One of the youngest provinces of the Canadian Shield is the Grenville where the mountain building event (orogeny) occurred from 1250 to 890 million years ago. One sample has a mineral assemblage of kornerupine (8%) + phlogopite (15%) + tourmaline (15%) + alkali feldspar (20%) + orthopyroxene (20%). The protolith (original material) for this rock was likely a boron-rich rhyolite (felsic volcanic rock). Schreyer (1997) suggested that the presence of aluminum increases the absorption of boron into the solid state at high-grade temperatures and pressures. In sample 2019K, there is aluminum in phlogopite and alkali feldspars. Based on the intergrown texture between xenoblastic kornerupine and idioblastic tourmaline, the kornerupine likely grew at the expense of tourmaline as the material reached peak metamorphic conditions. The proposed reaction is as follows; biotite + almandine + sillimanite + tourmaline à kornerupine + orthoclase (albite) + rutile. The presence of tourmaline and kornerupine together suggests that the range of temperatures and pressures represented by this sample would fall on the reaction curve. It has been proposed that these boron-rich localities could be traced out through the Grenville Province, possibly to define the location of an extensive pulse of felsic volcanism.
Keywords: Granulite; Metamorphism; Grenville; Boron; Gneiss
Supervisor: Katherine Boggs

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

Abstract title: Metamorphic Petrology in the Scottish Highlands

Authors: Matthew Gill

Abstract

George Barrow is referred to as the "Father of Metamorphic Geology" because he was the first to map the metamorphic gradient across the Scottish Highlands by recognizing the pattern of chlorite to biotite to garnet to staurolite to kyanite to sillimanite. This pattern represents an increase in metamorphic temperatures and pressures and is now referred to as the Barrovian zones and these minerals are known as index minerals. The divisions between the different zones are known as isograds which can be mapped. The work that Barrow did has influenced the way metamorphic geology is thought of around the world. Sample 2019E has the peak metamorphic mineral assemblage of kyanite in the politic layer, which implies that this sample came from the kyanite zone in the Scottish Highlands where Barrow did his original work. The was initially a pelite that has been exposed to the extreme pressures and temperatures of metamorphism to create a rock in the kyanite zone. Kyanite zone rocks formed in temperatures of 700 – 760 degrees Celsius and pressures of 7 to 9 kbars. This sample also had a layer with calcite and a calcium-rich amphibole, which lacked kyanite and created a distinctive boundary. This implies that the presence of calcium and carbonate (in the calcite) inhibited the growth of kyanite.

Keywords: Metamorphic Petrology, Geology, Regional Metamorphism, Alteration,

Supervisor: Katherine Boggs

Poster #1529, Presentation Time: 10:00 am - 12:00 pm

Abstract title: The Conniving Calcite Conundrum

Authors: Matthew Prince

Abstract

The Grenville Province of the Canadian Shield is famous for its anorthosite complexes including one of the world's largest - the Lac St Jean anorthosite at greater than 20,000 km2. Anorthosites form when a basaltic magma intrudes into the crust and stagnates, so that lighter less mafic minerals such as plagioclase can crystallize out and accumulate at the top of the chamber. This leaves the more mafic residual melt to sink down to the bottom. The conundrum is the presence of calcite in this sample; which is not typical of anorthosites. It is hypothesized that the original basaltic magma intruded into a limestone (which is a rock composed of calcite); resulting in a skarn-like meta-anorthosite. The sample contains approximately 35% plagioclase feldspar, 15-20% garnet, 10-15% clinopyroxene, 5-10% orthopyroxene, 10% calcite, and 10% wollastonite. This mineral assemblage is representative of granulite metamorphism facies. Other granulites are frequently associated with meta-anorthosites. Whereas the growth of garnet and pyroxene was the result of metamorphism on the anorthosite intrusive body, the calcite is from the limestone country rock. Wollastonite is formed under high temperature and pressure from calcite and quartz in the limestone (Cal + Qtz = Wo + CO2). Granulites can form at depths from 10-50 km, and a range in temperature of 700-100°C. However, given the location in the Canadian shield, and the continental geothermal gradient, this rock most likely formed under regional metamorphism at approximately 40 km depth - the thickness of the crust under Calgary - and around 800°C.

Keywords: Granulite; Anorthosite; Calcite; Skarn;

Supervisor: Katherine Boggs

Mathematics & Statistics

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

Abstract title: Spatial tracking of the current Ebola outbreak in Congo

Authors: Olga Koldachenko, Ashok Krishnamurthy, Loren Cobb, Michael Wendlandt and Murdoch McKinnon

Abstract

We present a spatial Susceptible-Exposed-Infectious-Recovered-Dead (S-E-I-R-D) compartmental model of epidemiology to capture the transmission dynamics and the spatial spread of the ongoing Ebola outbreak in the eastern region of Kivu in Congo. For the current outbreak in Congo we use registered data (province-wide weekly counts of total Ebola cases and confirmed dead) up to February 24, 2019 from the World Health Organization (WHO) situation reports.

"Data Assimilation" is a general class of techniques for tracking a state vector in time, using Bayesian updates applied to a dynamic model. Our results for the 2013-16 West African Ebola outbreak suggest that forecasting incidence using data assimilation can be produced in the domain of quantitative tracking of an epidemic across space and time (Krishnamurthy and Cobb, GEOMED, 2015). We observed that the prediction improves as data is assimilated over time.

The data assimilation layer receives sparse and error-prone epidemiological data from the field and uses this data to perform corrections to the current state vector of the epidemic. In other words, it enhances the operation of the spatial SEIRD model by periodically executing a Bayesian correction to the state vector(s), in a way that is, at least arguably, robust and statistically optimal.

The projected number of newly infected and death cases up to August 31, 2019 are estimated and presented. We provide a discussion and interpretation of our results. The data assimilation method presented herein can be applied to a large class of compartmental or even agent-based models.

Keywords: Ebola, Spatial Epidemiology, R Program, Mathematical Modelling

Supervisor: Ashok Krishnamurthy

Wildlife Behavior, Conservation & Ecology

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

Abstract title: The Role of Canis latrans (coyote) in the conservation of biodiversity of the Ann & Sandy Cross Conservation Area (ASCCA)

Authors: Moroni Lopez Vasquez

Abstract

The Ann & Sandy Cross Conservation Area (ASCCA) encompasses a total of 4800 acres (1942 hectares) donated to the province of Alberta with the purpose of preserving wildlife and native landscapes. Recently, neighbours of the conservation area have been luring coyotes out of the property with the intent to kill them. Since coyotes are now the apex predators in the ASCCA, reducing their numbers can have ecosystem-level consequences affecting the flora and fauna of the conservation area. I conducted a literature review concerning the role of apex predators, mesopredator release, and several case studies considering the ecological effects of coyote removal, among others. I concluded that luring coyotes out of the conservation area is an ineffective way to address human-coyote and livestock-coyote conflict. This technique has the potential to create even more problem for the neighbours of the ASCCA. Furthermore, loss of coyotes in the conservation area could have detrimental effects for the vegetation and impact breeding success of bird species such as the song sparrow, as well many ground nesting species. I suggest the current problem with coyotes is one of misinformation and biases against natural predators. I include suggestions for the ASCCA to educate neighbours and visitors as to the ecological/cultural/financial role of coyotes.

Keywords: ecological populations; apex predator; mesopredator release; coyotes; conservation

Supervisor: Dorothy Hill

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

Abstract title: The Role of Genetics & Parental Provisioning on Structural Plumage Coloration Development in Mountain Bluebird (Sialia currucoides) Nestlings

Authors: Nicole McClure

Abstract

Colorful plumage is a sexually selected trait in birds; research has shown that in many bird species colorful plumage contributes to an increase in reproductive success and survival rates. Structural coloration is a type of plumage coloration and is produced by microstructures within the medulla of the barbs and barbules of bird feathers. These microstructures produce the UV-blue coloration seen in Mountain Bluebirds (Sialia currucoides). We are interested in how this UV-blue structural coloration develops in Mountain Bluebird nestlings, and more specifically, whether genetics, parental investment, or both play a role. Research has shown that plumage coloration can be influenced by genetics, or the 'Good Genes Hypothesis', and parental investment, or the 'Good Parent Hypothesis'. The Good Genes hypothesis indicates that mates are chosen based on their genetic quality and their ability to pass these genes onto offspring, while the Good Parent Hypothesis indicates that individuals with higher quality ornamentation will be of higher parental quality and thus more likely to provision their offspring at higher rates. If this is the case, we could expect colorful structural plumage development in nestlings with parents that are of higher genetic and/or parental quality. For data collection, feeding watches were conducted and spectral measurements were taken at 36 nestboxes for mated pairs and their nestlings. Statistical analysis will be performed using the following: a color analysis program, principal components analysis and correlation & regression analysis. This poster will present our results and interpretations of the findings from these analyses.

Keywords: Structural plumage coloration; Mountain Bluebird nestlings; Genetics; Parental Provisioning; UV-blue
Supervisor: Melanie Rathburn

Poster #1902, Presentation Time: 2:00 pm - 4:00 pm

Abstract title: Identifying the genetic loci responsible for pelvic polymorphism in Culaea inconstans (brook stickleback) populations in Alberta, Canada

Authors: Moroni Lopez Vasquez

Abstract

Stickleback populations around the world are great subjects for the study of parallel evolution. Brook stickleback individuals are known to exhibit different pelvic phenotypes, with some stickleback having pelvic spines (ancestral trait), and other lacking pelvic spine development at all (derived trait). Alberta is home to the highest prevalence of unspined individuals among brook stickleback populations. The purpose of my research is to find the genetic loci responsible for pelvic polymorphism in brook stickleback. To do this, I am using brook stickleback DNA samples collected from Muir Lake (Alberta). By analyzing the DNA sequences of spined and unspined individuals, I will identify the genetic loci responsible for pelvic polymorphism. My hypothesis is that at least one of the genetic loci responsible for pelvic polymorphism is Pitx1, a gene involved with pelvic polymorphism in threespine stickleback, a closely related species. Based on these genetic analyses, I will also determine whether spined and unspined individuals mate at random or if assortative mating is taking place.

Keywords: phenotype; polymorphism; brook stickleback; ecological populations
Supervisor: Jonathan Mee

Late Breaking Abstracts

(alphabetical by first author's last name)

Poster #LB001, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Scotland Highlands Featuring the biotite zone of Barrovian Sequence
Authors: Mahdi Alaa, Matthew Gill
Abstract
The Scottish Highlands are the birthplace of metamorphic petrology where Barrow first recognized the pattern from chlorite – biotite – garnet – staurolite – kyanite – sillimanite that we now see in all regionally metamorphosed geological settings across our planet through more than four billion years of the geological time scale. The Grampian Orogeny (mountain building) formed this Barrovian sequence 470 million years ago. Sample 2019L has a peak metamorphic assemblage of muscovite + chlorite + biotite which places it in the biotite zone of the greenschist metamorphic facies. The zone is represented by pressure ranges of (0.2-0.8 GPa) and temperatures between (300-500°C) which is characteristic for producing such minerals in pelites (fine-grained sedimentary rocks) – the corresponding depth in the crust falls between (10-30 Km). One other rock, Sample 2019E, from the Scottish Highlands contains kyanite which places it in the kyanite zone of the amphibolite facies. This signifies a higher grade of metamorphism in pelites corresponding to higher P and T deeper in the crust. As Sample 2019L was brought to the surface, circulating fluids altered the feldspars to sericite.
Supervisor: Katherine Boggs

Poster #LB002, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Analyzing the Effectiveness of a Pilot Community Service Learning Project in the Undergraduate Chemistry Laboratory
Authors: Juhene Khalil, Hannah Grewal, , Kimberly Millis
Abstract
A semester-long Analytical Chemistry II laboratory pilot study was conducted with a Community Service Learning (CSL) component in a mid-sized undergraduate institution. According to the Canadian Alliance of Community Service-Learning, CSL is an educational approach that integrates community service with intentional learning activities. Research students previously developed two in-house methods to determine the amount of Total Dissolved Solids in drinking water. The community partner for the pilot study was chosen to be a local middle school based on the Alberta Education grade 8 science curriculum. Drinking water samples were collected by the community partner and were tested by undergraduate researchers. The findings were collaboratively analyzed between the two parties via video conferencing and compared to Canadian water quality guidelines. The undergraduate researchers later visited the community partner to disseminate the final results of the analysis. The effectiveness of undergraduate learning, community partner learning and overall attitudes toward chemistry could be determined by implementing post-instructional surveys targeting undergraduate students, grade 8 students and their educators.
Supervisors: Christopher Lovallo, Karen Ho

Poster #LB003, Presentation Time: 10:00 am - 12:00 pm
Abstract title: Terminal Velocity Applications are Dependent on Mass and Medium
Authors: Ashlyn Mackey, Solveig Thompson
Abstract
Terminal velocity occurs when an object is in free fall. When the force of gravity pulling an object down is equal to the force up from air resistance, the object can no longer accelerate and has reached its terminal

velocity. Calculations involving terminal velocity have applications such as: rocket re-entries, free-fall stunts, and submarine speeds. This investigation explores how terminal velocity varies depending on the mass of the object and the medium it is falling through. It was found that with a small mass, the terminal velocity is proportional to the ratio of mass over the drag coefficient determined by the medium. When that ratio is equal to 1, the terminal velocity can be no greater than gravity. With a large mass, the velocity is inversely proportional to the square root of the drag coefficient. The equation that is used to calculate terminal velocity depends on the situation. A thick medium, such as water or oil, requires the equation: $v(t) = \frac{m}{k}\ (g - ge^{\frac{k}{m}t})$ while a thinner medium, such as air, requires the formula:

$$v(t) = \sqrt{\frac{m}{k}}\ \frac{1-e^{-2\sqrt{\frac{kg}{m}}t}}{1+e^{-2\sqrt{\frac{kg}{m}}t}}$$

Supervisor: Mariya Svishchuk