

# 2015 Science Graduate Studies Day Abstracts

May 1<sup>st</sup>, Don and Marion McDougall Hall & Schurman Market Square  
University of Prince Edward Island

## Keynote speaker presentation:

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- **Joseph Pawlik**

- **The chemical ecology of sponges on Caribbean reefs: How natural products shape natural systems**

Sponges are now the dominant habitat-forming animals on Caribbean reefs, where the combined effects of climate change, pollution, and disease have decimated reef-building corals. Natural products chemists have been isolating novel secondary metabolites from Caribbean sponges for many decades, but relevant studies of the ecological functions of these compounds have been more recent. Bioassay-guided surveys have revealed sponge chemical defenses against predators, competitors, and pathogens, but many common sponge species lack chemical defenses and appear to have followed a different evolutionary trajectory, investing instead in greater reproduction or growth. Our proposed conceptual model<sup>1</sup> predicts that changes in the abundances of predatory fishes on Caribbean reefs will have a cascading impact on the sponge community, with indirect effects on the broader community, including reef-building corals. A recent cross-Caribbean test validated important components of this model, with higher proportions of chemically defended sponges on reefs with greater numbers of sponge-eating fishes<sup>2</sup>, and greater competitive interactions between sponges and corals on those same reefs. Caribbean sponges provide an important alternative to more complicated systems, such as terrestrial plant and insect communities, for testing basic ecological theories about chemical defenses and resource allocation. The tractability of this system may result from its relative simplicity, particularly the apparent absence of bottom-up effects on community structure<sup>3</sup>

<sup>1</sup>Pawlik 2011. The chemical ecology of sponges on Caribbean reefs: Natural... BioScience 61:888-898

<sup>2</sup>Loh & Pawlik 2014. Chemical defenses and resource trade-offs... Proc Nat Acad Sci USA 111:4151-56

<sup>3</sup>Pawlik et al. 2013. Sponge communities on Caribbean coral ... PLoS One 8(5):e62573.

*Affiliation: Center for Marine Science, University of North Carolina – Wilmington, NC USA*

## Student oral presentations (alphabetical by first author):

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**ESC:** Environmental Sciences

**HUB:** Human Biology

**MMS:** Molecular and Macromolecular Sciences

- **Christian Agatemor (PhD MMS), Nola Etkin, Alaa Abd-El-Aziz**

- **Functional dendrimers from an Iron(II) sandwich complex**

Dendrimers are attractive platform for accessing functional materials. The dendritic macrostructure is unique, allowing multiple functionalizations as well as improving processibility. We designed a new family of bifunctional redox-active, photoactive dendrimer taking advantage of the dendritic topology. The synthetic route to these dendrimers is facile and versatile. An iron(II) sandwich complex,  $\eta^6$ -arene- $\eta^5$ -cyclopentadienyliron(II), that forms the dendritic branches imparts redox activity while peripheral naphthyl moieties that caps the termini gives photoactivity. A simple UV irradiation of this organometallic dendrimer results in purely photoactive organic dendrimer with a concomitant increase in fluorescence emission. This facile and versatile synthetic route will afford various functional dendrimers with range of applications.

*Affiliation: Department of Chemistry*

● **Aisha Alkhnajari<sup>1</sup> (MSc ESC), Kaushik Ghose<sup>2</sup>, Ashok Somalraju<sup>1</sup>, Karen Samis<sup>1</sup> & Bourlaye Fofana<sup>1,2</sup>**

○ **Metagenomics of the buckwheat rhizosphere's microbial diversity in wireworm-infested and non-infested soils**

Agricultural plant production is becoming one of the most challenging issues in this century due to plant diseases and pests affecting crop yields and crop value. Significant crop value losses have been attributed across Canada to wireworm, which has become a serious problem for growers. To control wireworm, the main option used by growers has been chemical pesticides, which negatively affect the quality of plant products and the environment. In recent years, crop rotation using buckwheat has appeared to be an environmentally friendly and effective strategy against wireworm. However, the mechanism by which crop rotation involving buckwheat fights wireworm is unknown. In this study, we assessed the microbial diversity in the buckwheat rhizosphere using metagenomics in comparison with uncultivated bulk soil.

*Affiliations: <sup>1</sup>Department of Biology & <sup>2</sup>Agriculture and Agri-Food Canada*

● **Michael Coffin, Cristina Pater, Simon Courtenay & Michael van den Heuvel**

○ **Effect of eutrophication on the invertebrate community and water quality of Southern Gulf of St. Lawrence estuaries**

Increased nutrient inputs, i.e. eutrophication, are having negative effects on estuarine health all around the world. Typically, there is a shift from a seagrass to an algae dominated plant community which can have myriad negative consequences both ecologically and economically. Many estuaries in the Southern Gulf of St. Lawrence are suffering from eutrophication and seagrass coverage and density are in rapid decline. In Prince Edward Island, where land use is intense and predominately agricultural, there are many estuaries where seagrass has been completely displaced by macroalgae in the upper estuary. In this study, we used a tiered monitoring strategy which incorporates water quality and benthic invertebrate monitoring. We selected estuaries from around the Southern Gulf region ranging from pristine to severely impacted. We monitored dissolved oxygen in the sampling area for each of the estuaries and observed frequent and prolonged anoxia in many of the estuaries with high nutrient loads. The impact of anoxia on the invertebrate community can be devastating, especially when it persists for several days. We present data from a field experiment where invertebrate samples were collected immediately prior to and immediately after an anoxic event. Results from this experiment, coupled with the previously collected monitoring data, lead us to a conceptual theory in which some invertebrates are able to escape hypoxic/anoxic events and also to recolonize them after an event has subsided.

*Affiliation: Department of Biology*

● **Andrew Doiron (MSc ESC) & Adam Fenech**

○ **Using small Unmanned Aerial Systems (sUAS) to assess and visualize the impacts of climate change**

Climate change is anticipated to bring more frequent, intense storms, sea level rise, and reduced sea ice coverage, which provides protection from wind and waves along the coast. As a result, coastal areas are especially vulnerable to the impacts of climate change. The Coastal Impact Visualization Environment (CLIVE) is an analytic geovisualization tool created by researchers at UPEI's Climate Research Lab and Simon Fraser University's (SFU) Spatial Interface Research Lab. CLIVE combines geographic information systems (GIS) and video game engine technologies to create 3D geovisualizations used to communicate coastal impacts and sea level rise. High resolution aerial imagery captured using small Unmanned Aerial Systems (sUAS) will be used to monitor and identify impacts of climate change in coastal areas at a fine temporal (daily, monthly, seasonally) and spatial scale (2 cm/pixel). Results will be integrated into a CLIVE environment and demonstrate the usefulness of sUAS technologies in environmental science.

*Affiliation: Climate Change Laboratory*

- **Krista Gill (PhD MMS), Fabrice Berrue & Russ Kerr**

- **Discovery of cystargamide and cystargolides A & B from the Actinomycete, *Kitasatospora cystarginea***

Microbial natural products have traditionally been an excellent resource for drug discovery. However extensive research conducted with *Streptomyces* has caused a high rate of reisolating known natural products, making discovery of novel compounds very challenging. To overcome this barrier an equally prolific but rarer relative, *Kitasatospora* genus was evaluated for the production of novel natural products. Twelve strains of *Kitasatospora* spp. were analyzed using LC-HRMS/PCA, which highlighted the production of a new lipopeptide that we have named cystargamide, and two new linear  $\beta$ -lactone containing peptides named cystargolides A and B. The therapeutic potential of these new natural products were evaluated in several bioassays. Cystargamide was found to moderately inhibit Human Phospholipase A2 in vitro. Cystargolides A and B were found to potently inhibit human 20S Proteasome in vitro, and moderately inhibit growth of the Breast Cancer Cell Line HTB-26. These novel bioactive peptide natural products reveal the excellent potential of the genus *Kitasatospora* to produce novel bioactive natural products that may have potential application in human health.

*Affiliation: Department of Chemistry*

- **Travis James (MSc ESC) & Michael van den Heuvel**

- **Halibut (*Hypoglossus hypoglossus*) in the Gulf of St. Lawrence**

Atlantic halibut are the largest of the flatfish and a species of significant commercial interest throughout its range. Despite widespread fisheries, relatively little is known about this fish. In the Gulf of St. Lawrence there is very little information about halibut movement patterns and breeding habits. Since halibut spend most of their life in deep water and are believed to breed in winter, it is difficult to study them directly. Through the use of archival and traditional tagging methods, combined with genetic information, it is hoped that we can better understand their movements and potential population structure.

*Affiliation: Department of Biology*

- **Luke Poirier<sup>1</sup> (PhD ESC), Lynn Symington<sup>1</sup>, Jeff Davidson<sup>2</sup>, Sophie St-Hilaire<sup>2</sup> & Pedro Quijon<sup>1</sup>**

- **The European green crab—finding alternative uses for an invasive predator in Prince Edward Island**

Over the past decade and a half, the growth of green crab (*Carcinus maenas*) populations has become a concern to the sustainability of shellfish resources and healthy aquatic systems in Atlantic Canada. The development of a “soft-shell” industry is an option that could mimic the successful soft-shell Mediterranean crab (moleche) industry in Venice, Italy. In order to assess its feasibility, a pilot project was initiated in PEI in spring 2014 and a subsequent visit to Venice (spring 2015) to confirm fishery characteristics. Crabs were collected using both passive and active trapping methods and external physical characteristics were carefully identified and recorded based on traditional knowledge later confirmed by Venetian moleche fishers. Crabs were then held in individual compartments for 2-3 weeks and molting occurrence was observed. Initial results suggest synchronized “molting windows” during the spring (males) and autumn (females). Based on preliminary molting rates, a second phase of this study intends to work in co-operation with local shellfish processors to assess the feasibility of an economically viable and ecologically sustainable strategy based on molting recognition or induction in green crabs

*Affiliations: Departments of <sup>1</sup>Biology & <sup>2</sup>Health Management*

- **Gillian Potter (MSc HUB) & William Montelpare**

- **Examining pain anxiety in young adult athletes**

Injuries from overuse as well as direct trauma are common among athletes. The ability to sustain participation in light of such injuries may be a function of an athlete’s pain anxiety – defined as fearful and anxious responses toward pain. Investigating the underlying constructs of pain anxiety may have important implications for facilitating injury recovery and subsequent return to play. The objectives of the current study were to examine pain anxiety in a cohort of young adult athletes, and to evaluate the predictability of demographic variables, self-reports of pain, injury history, emotional stress, athlete identity, and physical

activity level on pain anxiety scores. This study was conducted in two phases. In Phase 1, the Pain Anxiety Symptom Scale 20 (PASS) was used to collect pre-season pain anxiety measures in a cohort of 92 varsity-level athletes. In Phase 2, a follow-up cohort of athletes was asked to complete the PASS and selected measures purported to predict pain anxiety.

*Affiliation: Department of Applied Human Sciences*

- **Adam J Proud (PhD MMS) & Jason K Pearson**

- **The development of the localized pair model**

There is often a divide between the interests of many computational chemists and their experimental colleagues. While much of quantum chemistry involves the study of electrons delocalized over full chemical systems, much of chemical reactivity is the result of localized regions of a molecule. Herein, we present the proposed development of a software package to analyze electron pair distributions in localized molecular orbitals (LMOs). These LMOs depict chemical bonds and lone pairs; two concepts that are far more chemically intuitive than their delocalized counterparts. The software package will allow a user to specify a localized molecular orbital and analyze the electron pair behaviour within that orbital using a variety of techniques. These include the analysis of properties such as interelectronic distances, centre-of-mass distributions, and relative and/or average momenta. Using this tool, users can compare the resulting properties between chemical systems with different functionalities or the effect of using different computational techniques

*Affiliation: Department of Chemistry*

- **Josh Slyzs (MSc HUB) & Jamie Burr**

- **The physiological effects of blood flow restricted muscle stimulation (arm and leg phases)**

Background: Emerging evidence suggests that low load exercise stimuli can lead to significant muscular adaptations when blood flow to a muscle is restricted. Transcutaneous electrical muscle stimulation (TEMS) has been used for a number of years in rehabilitative settings, but muscular adaptation as a result of stimulation is limited, most likely owing to the discomfort caused by the high intensity stimulus. Combining low intensity TEMS with blood flow restriction (BFR) has yet to be examined, and offers the potential to stimulate substantial muscular adaptation without undue discomfort. Purpose: To examine the effects of combining BFR with a low intensity TEMS on the upper body and lower body. Methods: BFR and TEMS were used simultaneously on the forearm muscle and the upper leg muscle four times a week for six weeks. To test the adaptation of the muscles, strength and hypertrophy were tested at baseline and after 6 weeks of training. Results: Results are currently being analyzed but trends suggest TEMS + BFR and BFR lead to the greatest muscular adaptation.

*Affiliation: Department of Applied Human Sciences*

- **Amanda Sproule (MSc MMS), Fabrice Berrue, B Haltli & Russ Kerr**

- **Co-culture mimic as a directed approach to the discovery of bioactive natural products**

The fermentation of microorganisms provides an environmentally friendly route for the discovery of new natural products. Due to their wide range of bioactivity, natural products make excellent drug leads and are also becoming popular active ingredients in the personal care and cosmetics industries. Unfortunately, under standard laboratory conditions, microbial fermentation often leads to the rediscovery of known compounds which wastes time and resources. There is therefore a need for innovative strategies to find new compounds. The Kerr Group has developed a technique called co-culture mimic which attempts to activate silent gene clusters of the producing microorganism to access elusive and putatively novel natural products. By applying this technique in a serial manner, it may be possible to discover natural products with desired bioactivity against specific pathogens. This project will use this directed approach in an attempt to discover new natural products for use as active ingredients in the personal care industry.

*Affiliation: Department of Chemistry*

● **Colin Stetson<sup>1</sup> (MSc HUB), Robert AR Hurta<sup>1</sup> & Jason L McCallum<sup>1,2</sup>**

○ **Demonstrated anti-cancer effects and chemical profiling of select fruit extracts**

This research investigates how plant-derived natural products control cell growth in cancer cells, with a focus on berries & fruits from 23 under-utilized agroforestry crop species. The fruit of each plant was lyophilized and extracted using a “universal solvent” extraction. Crude extracts were initially analyzed using UPLC-MS to provide general chemical classifications. The Alamar blue assay was used to determine cell viability of human breast and prostate cancer cells after treating with 50, 100 and 200 µg/mL of each crude extract for 24 hours. Multiple extracts exhibited significant cytotoxicity and one fruit extract, nannyberry, was selected for further study. Using UPLC-MS, three compounds present in the extract have been identified novel to this plant. Studies are currently on-going to determine if these compounds are responsible for the exhibited anti-cancer effects of the nannyberry extract (Funding provided by Agriculture and Agri-Food Canada, A-base, Project 1268)

*Affiliation: <sup>1</sup>Department of Biology & <sup>2</sup>Agriculture and Agri-Food Canada*

**Poster presentations (alphabetical by first author):**

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● **Amani Abdelghani (Visiting PhD student), Alaa Abd-El-Aziz & Jason Pearson**

○ **Studies on the photochemical properties of synthesized novel dendrimers with chromophoric molecules**

Aggregation generally quenches the light emissions of chromophoric molecules. In 2001, the opposite phenomenon termed aggregation-induced emission (AIE) was first reported by Tang's group(1). Many aromatic organic molecules have desirable UV absorption and strong emissions which exhibit high fluorescence; for instance, siloles, coumarin dyes, BF<sub>2</sub> complexes and pyrans. Some of these compounds are practically non-luminescent when molecularly dissolved in their good solvents, especially when their solution concentration is increased due to formation of sandwich shaped excimers and exciplexes, (aggregation-caused quenching or ACQ). However, they become highly emissive upon aggregation in their poor solvent or in solid state. Moreover, solvent and time influence photoluminescence of aggregation induced emission enhancement (AIEE). As well as, temperature when the mixture is cooled its emission intensity further increases. The aim of our research is to study the aggregation of some synthesized dendrimers that contain sandwich organoiron complex, η<sup>6</sup>-arene-η<sup>5</sup>-cyclopentadienyliron(II). These dendrimers introduce some chromophoric molecules in some generations. In this study different solvent with various concentrations will be used. Also, the effect of temperature, time influence and the generations of dendrimers will be examined.

*Affiliation: Department of Chemistry*

● **Qammar Almas (PhD MMS) & Jason Pearson**

○ **Density functional theory benchmark for the structure and reactivity of frustrated Lewis Pairs**

Steric hindrance due to bulky groups attached to the Lewis acids and bases precludes the formation of the Lewis acid-base adduct and gives rise to a metal-free small molecule activation. These Lewis pairs are termed as Frustrated Lewis Pairs (FLPs). To theoretically investigate the structure and reactivity of FLPs, a computational benchmark has been made on the chemistry of FLPs. 25 computational methods, have been employed on a test set of molecules for potential energy calculations at varying bond lengths. The test set consists of 12 Lewis acid-base pairs (mimicking FLPs) with varying acceptor/donor and ligand combinations. The performance of the 24 computational methods is compared by an extrapolated reference method, CCSD(T)/CBS. It has been found that BMK, PBE0, PBE0-D and EDF2, performs with smaller errors compared to other methods used but BMK, PBE0 and PBE0-D are the methods with least error values and are following the energy trends same as by the reference method.

*Affiliation: Department of Chemistry*

- **Laura Carvalho (MSc HUB), Chelsea Sanderson, William Montelpare & Rebecca Reed-Jones**
- **Defining postural control over first time trials of Nintendo Wii game play**

Purpose: Interactive gaming systems, such as the Nintendo Wii, are seeing increased use as a tool for providing objective measures of balance. Unlike other balance assessment tools used in concussion assessment, it requires both motor and cognitive performance. The purpose of this study was to assess changes in postural control during Nintendo Wii game play over a series of first-time trials among uninjured athletes. Methods: We measured baseline postural control measurements during Wii game play for 30 university athletes. Each athlete completed four trials of the Nintendo Wii Fit Soccer Heading Game. Postural kinetics was measured by placing the Wii Balance Board on top of a force platform. Centre of pressure (COP) was calculated in the anterior-posterior (AP) and medial-lateral (ML) direction for each 70-second time trail at 1000 Hz. Results: A significant increase in COP ML velocity was found between trial 1 and trials 2-4 ( $p = 0.026$ ). ML velocity was observed to continue to increase between trials 2 and 3, however was not statistically significant. No significant changes in velocity were found in the AP direction. Conclusions: These data suggest that COP control stabilizes after the first trial of the Nintendo Wii Soccer Heading Game, an important consideration in reliability of assessment. Stabilization of the magnitude of COP appears to occur first, followed by velocity that may in fact continue to fluctuate over repeated trials

*Affiliation: Department of Applied Human Sciences*

- **Ebtehal El-Ghezlani (PhD MMS) & Alaa Abd-El-Aziz**
- **Synthesis and Characterization of some novel organoiron compounds**

An extensive study was conducted for the applied research activities in the biological environment of organoiron compound ferrocene. Especially, for research focusing in chemotherapy of antitumor. Some ferrocenium salts were tested against several types of tumor cells and ascites disease in mice and human and showed a significant microbiological effect which caused a 50% to 100% cure rate. In particular, chromene is one of the privileged medicinal pharmacophore which appears as an important structural component in natural compounds and generated a great attention because of their interesting biological activity. Chromene derivatives possess important biological activities such as antitumor, antivasclar, antimicrobial, antioxidant, antifungal, estrogenic, antiviral, anticancer, anti-HIV antitubercular, anti-inflammatory. In this work, synthesis various new compounds that composed of iron complexes, ferrocene monocarboxylic acid and 4H-chromenes were achieved, and, furthermore, these compounds were characterized by by  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR, IR, and carbon, hydrogen analysis.

*Affiliation: Department of Chemistry*

- **Justin Ferrish (MSc ESC) & Karen Samis**
- **Identifying variation in salt tolerance between ecotypes of a coastal plant**

Salinity tolerance is a vital trait in coastal plants. The core of my research is to assess the physiological and molecular genetic basis of salinity tolerance in a coastal plant, as a means to understand the evolution of salt tolerance in plants. To describe variation among ecotypes, I will use a combination of greenhouse experiments and transcriptome analysis, in each case assessing plastic and genetic variation expressed under various levels of salinity exposure. Early exposure treatments have revealed variation between marine and lacustrine ecotypes in the direction expected. That is, Atlantic ecotypes are taller, have higher chlorophyll fluorescence, and an earlier time to flowering compared to the Great Lakes ecotype. These results suggest that the Atlantic ecotype (*edentula*) displays higher fitness when under salinity stress than the Great Lakes ecotype (*lacustris*), and that there is a variation in salinity tolerance

*Affiliation: Department of Biology*

- **Hannah Gehrels (MSc ESC), Jessica Willis, Andrey Malyshev & Pedro A Quijon**
- **Hide and seek: Habitat-mediated interactions between native mud crabs and invasive green crabs**

The habitat in which predator-prey interactions take place may influence the outcome of these interactions. This study explores how increasing habitat complexity (lack of habitat, sandy sediments, and oyster beds)

influences predation and preference rates by the invasive green crab (*Carcinus maenas*). Native mud crabs (*Dyspanopeus sayi*) and juvenile green crabs of similar size were used as prey in 24 h experiments. Large green crabs consumed almost twice as many mud crabs compared to juvenile green crabs in the lack of habitat and in sandy sediments, but predation rates were statistically similar in oyster beds. Habitat types did not seem to affect juvenile green crab mortality, but oyster beds decreased mud crab mortality by ~65% compared to no substrate. These results support the idea that complex habitats mediate predator-prey interactions, and dampen the effect of prey preference. As green crabs continue to invade areas dominated by mud crabs, they may threaten the sustainability of this native species.

*Affiliation: Department of Biology*

• **Daniel Gillespie<sup>1</sup> (MSc HUB), Katherine Gottschall-Pass<sup>2</sup> & Marva Sweeney-Nixon<sup>1</sup>**

○ **Blueberry Purée Increases HDL-cholesterol in Rats**

Oxidative stress has come to the forefront as a contributor to a number of diseases, including cancer, neurodegenerative and cardiovascular diseases (CVD). High-fat diets (HFD) contribute to oxidative stress as oxidized LDL leads to atherosclerotic plaques that contribute to CVD. Blueberry (BB) polyphenolics are thought to act as antioxidants, which can potentially mitigate oxidative stress and improve CVD outcomes. The objective of our study was to evaluate the effect of a HFD supplemented with BB puree on serum lipids and biomarkers of oxidative stress. Male Wistar-Kyoto rats (n=7) were fed either a control diet (CON), CON with 5mL/kg BB (CON+BB), 20% lard diet (HFD) or HFD with BB (HFD+BB) for eight weeks. A serum lipid panel was measured in a clinical lab analyzer and urinary 8-isoprostane, a marker of lipid peroxidation, was measured using a Cayman kit. HDL in CON group was  $0.747 \pm 0.014$  mM and was increased by 10% in CON+BB to  $0.822 \pm 0.019$  mM (p=0.002, ANOVA). All other serum lipids and urinary 8-isoprostane were not significantly changed by either HFD or BB enrichment. We have shown that feeding BB with a normal, healthy diet can improve serum HDL, which could potentially increase excretion of cholesterol from artery walls, improving CVD.

*Affiliation: Departments of <sup>1</sup>Biology and <sup>2</sup>Applied Human Sciences*

• **Bastian Herzog<sup>1\*\*</sup>, David Overy<sup>1</sup>, Bradley Haltli<sup>1</sup> & Russ Kerr<sup>1,2</sup>**

○ **Feather Biodegradation with Keratinases**

Specific enzymes called keratinases are necessary to biodegrade the recalcitrant protein keratin that is the main structural component of feathers, horns, hooves, wool, hair and fingernails. Keratin is classified as  $\alpha$ ,  $\beta$  and  $\gamma$ -keratin, according to the internal crosslinking of disulfide bonds making it very stable against degradation. Keratin is further strengthened by hydrogen bonds and several hydrophobic interactions. However, keratin does not accumulate in the environment due to the activity of enzymes known as keratinases that possess a large potential for a variety of biotechnological applications, e.g. treat keratin-containing wastes, to enhance nutrient availability when feather meal is used as feedstock, for the leather industry, for human skin-/haircare formulations or as additive to laundry and dishwashing detergents. To obtain keratinases, feather associated bacteria were isolated using a workflow incorporating an azokeratin-based assay to detect keratinase production and ultimately yielded 50 bacterial isolates. Their keratinases were assessed for activity at 55°C and most of them were remarkable thermostable. Such characteristics make these enzymes potential hits for a variety of industrial applications.

*Affiliation: <sup>1</sup>Nautilus Biosciences Canada Inc & <sup>2</sup>Department of Chemistry. \*\*: Postdoctoral Associate*

• **Kyle Knysh (PhD ESC), Michael van den Heuvel & Donna Giberson**

○ **Habitat changes affecting mayfly, stonefly and caddisfly species (Ephemeroptera, Plecoptera and Trichoptera) in Prince Edward Island pool springs**

Springs are unique groundwater dependent habitats that maintain consistent temperatures. Cool springs are home to uniquely adapted species that tolerate year round low temperatures. Springs are transition habitats, receiving inputs from surrounding terrestrial, surface-water and groundwater systems. Land-use, such as agriculture, can alter inputs into springs changing their habitat structure. These alterations influence species

diversity, abundance and life-cycle characteristics. Springs were sampled for insects in the orders Ephemeroptera, Plecoptera, Trichoptera (EPT) using emergence traps from May-October 2011 to examine species responses to quantified habitat differences in five springs near agriculture land and four springs in forested sections of eastern PEI. Overall, twenty-four EPT species were collected. Ephemeroptera were rarely collected; however, diversity and abundances of Plecoptera and Trichoptera were higher in agricultural springs. One Trichoptera species abundances were lower in agricultural springs and two Plecoptera species emerged earlier in agricultural springs. Species specific results were due to vegetation differences

*Affiliation: Department of Biology*

- **Sean Landsman (PhD ESC) & Michael van den Heuvel**

- **Giving fish a helping hand: Evaluation of fish passage structures in PEI rivers and streams**

The construction of dams on rivers and streams can impede access to upstream habitat for fishes. One method of mitigating the impacts dams have on fish populations is to build fish passage structures that are designed to help fish bypass obstacles. Our goal in this study is to evaluate the effectiveness of a specific style known as “nature-like fishways” for application on PEI. We used telemetry to remotely monitor free-swimming rainbow smelt, alewife, and brook trout on multiple rivers to assess performance of nature-like fishways. Our preliminary results show clear differences in passage efficiency among species and highlight potential problem areas. Research is ongoing and will continue into 2015 where we hope to increase the spatial resolution of our monitoring efforts

*Affiliation: Department of Biology*

- **Travis McIsaac (MSc HUB) & Dany MacDonald**

- **Exploring the relationship between negative sport experiences and positive youth development**

This proposed study aims to understand the relationship between negative sport experiences and positive youth development (PYD). The 40 developmental assets outlined by Benson (1997) will be used to assess developmental outcomes. These assets can be divided into internal assets (i.e. positive values) and external assets (i.e. support). Although organized sport has the potential to foster many of these assets in youth (Fraser-Thomas et al., 2005), research examining the impact of negative sport experiences is scarce. Thus, the following three experiences will be examined to determine their impact on PYD: burnout, competitive anxiety, and negative coach-athlete relationships. Male and female youth sport participants aged 16-19 will be recruited for the study, and will complete four measures: Developmental Assets Profile, Athlete Burnout Questionnaire, Competitive State Anxiety Inventory, and Coach Athlete Relationship Questionnaire. Results from the study should provide important information about the role of negative experiences in fostering positive outcomes in youth

*Affiliation: Department of Applied Human Sciences*

- **Julia McKenna (MSc HUB) & William Montelpare**

- **The stability and validity of HRV and CAS TEOAE in university aged individuals**

This study measured relationships between baseline estimates of physiological functioning that may be influenced by concussion injury. Specifically, measurement of contralateral suppression of transient evoked oto-acoustic emissions (CAS TEOAE) and heart rate variability (HRV). A three-part approach was taken to evaluate the stability and validity of these methods. For part one: A cohort of 25 university aged participants were best tested on two separate occasions with two weeks between the sessions on HRV and CAS TEOAE. Statistical analysis was used to evaluate each test between testing session to establish test stability. Non-parametric statistical analysis was used, as HRV is variable by its very nature. Using the McNemar Chi-Square all variables were found to not be statistically different ( $-1.96 < x < 1.96$ ). The Kappa z-score of agreement found that all HRV seven variables and four, out of the eight tested CAS TEOAE variables showed significant agreement. In conclusion, these variables were found to be reliable measures in healthy individuals.

*Affiliation: Department of Applied Human Sciences*

● **Mark Nabuurs<sup>1,2</sup> (PhD MMS), Susan M. Boyetchko<sup>2</sup>, Jason L. McCallum<sup>2,3</sup>, Aaron AS Mills<sup>2</sup>, Ting Zhou<sup>2</sup> & Chris W. Kirby<sup>1,2</sup>**

○ **Searching for biopesticides with bioautography**

Biopesticides, defined as living organisms and/or their natural products, are used to control or suppress pest populations. Bioautography is a high through-put bioassay technique in which crude extracts are separated on TLC plates, microbial spore suspensions are directly applied to the plates, they are allowed to incubate, and any zones of growth inhibition are indicative of active compound(s). Our laboratory searches for potential biopesticide candidates by investigating an inventory of natural resources comprised of several plant and bacterial species. We have adopted bioautography as our preferred in vitro methodology in our search for compounds capable of controlling plant pathogenic fungi. After the assay, we analyze the zone of inhibition by UPLC-MS which allows us to determine the identity of the active compound(s) via comparison to natural products databases. If the compound(s) are unknown, they are structurally characterized by NMR and HRMS.

*Affiliations: <sup>1</sup>Department of Chemistry, <sup>2</sup>Agriculture and Agri-Food Canada, <sup>3</sup>Department of Biology*

● **Heidi O'Brien (MSc HUB) & William Montelpare**

○ **Analysis of past concussions and current health measures: Long term impacts of concussion on cognitive, emotion and general health scores in a cohort of adults age 40-65**

The presence of concussion in junior, amateur and professional sport is more prevalent and known than ever before. Current concussion research looks to prevent, cope and treat concussions. Little research has been done on the long-term impacts of concussions on older adults, relative to Quality of life, cognitive decline, current health status or psychological wellbeing. The purpose of this study was to (a) generate a multidimensional variable to measure cognitive decline using The Shankle Memory Test and CFQ: Cognitive Failure Questionnaire (b) compare history of concussion in adults aged 40-65 on their measure of cognitive decline (c) identify a number from the general population of those impacted by concussion (d) to assess scores on mental health, physical health, and quality of life in a population of middle aged adults with reported history of concussion, and non reported history of concussion healthy. Predictions expect to show a significance relationship between older adults history of concussion and their scores on the measures of cognitive decline. This is a multivariate research approach looking to show predictors of health outcomes in an adult population and to support research of long-term impacts of concussion.

*Affiliation: Department of Applied Human Sciences*

● **Naomi Alan Robbins<sup>1</sup> (MSc ESC), Yefang Jiang<sup>1,2</sup>, Judith Nyiraneza<sup>2</sup>, Michael van den Heuvel<sup>1</sup>, Aaron Mills<sup>1,2</sup> & Christine Noronha<sup>1,2</sup>**

○ **The Effects of buckwheat as a potato rotation crop on soil and water quality**

Potato production plays a significant role in the economy in Prince Edward Island. Contamination of groundwater and associated surface water has been linked to the high levels of nitrogen losses from the potato production systems. The industry is under pressure to mitigate the environmental impacts while maintaining competitiveness; meanwhile a wireworm infestation is damaging potato tubules. Buckwheat –a wireworm biofumigant— with different crop termination methods (mowing, disking, and for seed), are compared to two current industry standards (red clover/timothy) were planted in 2014. Concentrations of nitrogen & phosphorus in H<sub>2</sub>O will be measured using steel lysimeters & soil piezometers. Nitrogen and carbon mineralization will be assessed on sampled soils from the root zone (0-15 cm), plowpan (15-30cm) and the unsaturated zone (30-45cm). Anion Exchange Membranes were replaced monthly to measure nitrate. This study will show if growing buckwheat as a rotation crop improves water and soil quality compared to the industry standard rotation systems.

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- **Tessa Roche (MSc HUB) & William Montelpare**

- **Assessment of balance behaviours, eye-movement, and attention in athletes: A step towards a more comprehensive concussion return-to-play protocol**

The most common assessment tool for deciphering balance dysfunction is the balance error scoring system (BESS), which may not be sensitive enough to determine balance changes post-injury. Balance disturbances are primarily a result of disruptions to the vestibular system, which is directly linked to the visual system. The visual system can be assessed using eye-tracking devices for an analysis of the vestibulo-ocular reflex (VOR) and the fixation reflex for a more comprehensive return-to-play protocol. Dynamic balance, and dual-task dynamic balance tests are also on the forefront of concussion assessment, and are available in the form of the Nintendo WiiFit Balance Board. University-aged participants performed the BESS and the Attention Network Test (ANT) followed by the Nintendo WiiFit Soccer Heading Game while wearing the ASL eye-tracking device. Actual game scores produced by the WiiFit, as well as eye deviations from centre, percentage of time that gaze was centered, and scores from the BESS and ANT were measured. The subjects were re-tested for reliability after two weeks and the BESS, ANT, eye measures and WiiFit overall scores demonstrated reliability as determined by using the Intraclass correlation coefficient approach.

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- **Ashok Somalraju<sup>1,2</sup> (MSc ESC), Kaushik Ghose<sup>2</sup>, D Main<sup>2</sup> & Bourlaye Fofana<sup>2</sup>**

- **Characterizing EMS-Mutagenized pre-breeding potato lines using NGS and Phenotyping**

Potato and its processed products are major components of modern diets. However, anti-nutritional factors like steroidal glycoalkaloids (SGAs) and acrylamide precursors accumulate at toxic levels in potato depending on the variety and storage conditions. Breeding out anti-nutritional factors using traditional methods is time consuming whereas transgenic approaches are of public concern. Hence current study aims at developing and characterizing pre-breeding potato lines low in anti-nutritional factors using EMS induced SNP discovery in asparagine synthetase 1 (AS1), asparagine synthetase 2 (AS2), solanidine galactosyltransferase (SGT1) and solanidine glucosyltransferase (SGT2) genes along with phenotyping. EMS treatment induced visual phenotypic variations in plant morphology and tuber characteristics. SNP calls from targeted amplicons resequencing using NGS within 1,750 EMS-treated and 140 non-treated lines identified 257 EMS-induced exonic SNPs including 109 sense mutations, 124 missense, and 24 nonsense SNPs. Although preliminary, the data of this non-transgenic approach suggests the possibility of generating pre-breeding germplasm with altered biosynthetic pathways of anti-nutritional factors.

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- **Bettina Sommer<sup>1\*\*</sup>, David Overy<sup>1</sup> & Russ Kerr<sup>1,2</sup>**

- **Lipases from *Malassezia restricta* nucleotide sequence, recombinant expression and proof of activity of MrLip1 and MrLip4**

*Malassezia* species are part of the normal cutaneous microflora and are known as opportunistic pathogens resulting in skin diseases like dandruff. It is widely accepted that colonization of the scalp by *M. restricta* and *M. globosa* may cause dandruff as the most effective antidandruff treatments are antifungal agents, like zinc pyrithione. Most members of the genus *Malassezia* do not possess a fatty acid synthase resulting in a unique lipid dependency. The need to assimilate fatty acids from external sources is reflected in the expression of several lipases. The sequence from *M. restricta* indicates at least the presence of four lipases, but no sequences are published yet. However, our analysis of the incomplete and unannotated genome from *M. restricta* revealed eight contigs containing three complete and five incomplete lipase sequences. Two of these, MrLip1 and MrLip4, were cloned, recombinant expressed in *Pichia pastoris* and tested for their activities against mono- di- and triacylglycerol substrates. While MrLip1 was only able to hydrolyze mono- and diacylglycerols, MrLip4 was also able to hydrolyze triacylglycerols.

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• **Paula Tummon Flynn (PhD ESC), David Cairns & Pedro Quijon**

○ **The history of Irish moss (*Chondrus crispus*) in Basin Head MPA and the potential role of the green crab (*Carcinus maenas*) in its decline**

In Basin Head lagoon, PEI, a unique form of Irish moss (*Chondrus crispus*) has been found to grow in close association with blue mussels (*Mytilus edulis*). Unlike coastal Irish moss that uses holdfasts to attach to substrates, this form is held in place by mussel byssal threads, forming moss-mussel clumps. Since the early 2000's there has been a significant loss of this red alga in Basin Head, with surveys citing declines in abundance of greater than 99%. As this decline corresponds to the arrival and spread of the invasive green crab (*Carcinus maenas*) in this area, we hypothesize that the green crab has contributed to the decline and discuss several possible mechanisms by which they may harm this unique algae.

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