



March 2-4, 2012
Sackville, New Brunswick

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Science Atlantic's 42nd Student Biology Conference





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| | Tweedie Hall | | |

Best parking: **P**

Friday registration/reception/poster displays: **11**

Saturday/Sunday talks: **22**

Meals: **30**

Science Atlantic Biology Student Conference schedule

Friday, Mar 2

- 17:00–20:00 Joint Registration (outside Tweedie Hall, Wallace McCain Student Centre)
- 17:00–19:00 Poster Setup (Tweedie Hall)
- 18:30–20:00 Mixer with cash bar (Tweedie Hall)
- 19:00–21:00 Science Atlantic Committee Meetings (McCain Student Centre rooms 124, 125, 130)

Saturday, Mar 3

- 8:00–9:00 Registration/Poster Setup (Tweedie Hall)
- 9:00–9:15 Joint Welcoming remarks (Dunn 113)
- Berkeley Fleming VP, Academic & Research, Mount Allison University
Robert Hooper, Chair of Science Atlantic Biology Committee
Jim Duston, Chair of Science Atlantic Aquaculture & Fisheries Committee
Van Lantz, Chair of Science Atlantic Environment Committee

Biology 1 (Dunn 113)

- 9:30–9:45 Sara Thomas: Acadia University
Photophysiology of *Bolidomonas pacifica* L.Guillou & M.-J.Chrétiennot-Dinet
- 9:45–10:00 Joseph Sanford: University of New Brunswick, Saint John
Screening for Antimicrobial Extracts from Marine Algal Endophytes
- 10:00–10:15 Karissa Milbury: Dalhousie University
Identification of Halophilic Protozoa via Environmental PCR
- 10:15–10:30 Annie Livingstone: St. Francis Xavier University
A sequence of events: unraveling the story behind an algal-vertebrate symbiosis
- 10:30–11:00 Joint Break & Poster viewing (Tweedie Hall)

Biology session 2 (Dunn 113)

- 11:00–11:15 Lauren Fogarty: Acadia University
Listening in the Fast Lane: Detecting Harbour Porpoise Activity in the Minas Passage
- 11:15–11:30 James Postlethwaite: Cape Breton University
The changing Bumble Bee (Hymenoptera: Apidae: *Bombus*) fauna of Cape Breton Island, Nova Scotia

- 11:30–11:45 Jason Laurich: Memorial University of Newfoundland
Seasonal variation in the symbiont abundances of thyasirid clams (*Bivalvia*: Mollusca) from Bonne Bay, Newfoundland
- 11:45–12:00 Jordan Poley: University of Prince Edward Island
Effects of immunostimulatory feeds on atlantic salmon (*Salmo salar*) responses to sea lice (*Lepeophtheirus salmonis*) infection
- 12:00–12:15 Andrea Flynn: St. Francis Xavier University
Coronilla varia (Crown Vetch) as an Invader of Mahoneys Beach, Antigonish, Nova Scotia
- 12:15–12:30 Amy Lamb: Cape Breton University
Re-description of *Captorhinikos valensis*, a fossil reptile from the Permian of Texas
- 12:30–13:30 Lunch (Jennings Hall)
- 13:45–14:45 Keynote speaker – Dr. Ian Mauro, Mount Allison University (Dunn 113)
The Science of Storytelling: A Digital Dispatch on Biotechnology and Climate Change
- 14:45–15:45 Poster Session, presenters required (Tweedie Hall)
- 15:45–16:15 Joint Break (Tweedie Hall)

Biology session 3 (Dunn 113)

- 16:15 –16:30 Christine Gilroy: Mount Allison University
Effects of temperature and tidal exposure on survivorship and behaviour of *Corophium volutator*
- 16:30 –16:45 J. L. Lutes: Nova Scotia Agricultural College
Humeral Bone Health in Laying Hens (*Gallus gallus domesticus*) Housed in Conventional and Furnished Cage Systems: Does Expression of Wing-Loading Behaviour Contribute to Bone Strength?
- 16:45 –17:00 Samuel Cripps: Nova Scotia Agricultural College
Effect of size of ewes and various placental components on lamb growth
- 17:00 –17:15 Rebecca Ann Standen: University of New Brunswick, Fredericton
Assortative mating by size in Atlantic puffins (*Fratercula arctica*)

17:15 –17:30 Alexandra Ouedraogo: Saint Mary’s University
Role of parental age on European starling (*Sturnus vulgaris*) Brood sex ratios

19:00–21:00 Banquet with cash bar (Jennings Hall)

Sunday

9:00–9:30 Poster session presenters required (Tweedie Hall)

Biology session 4 (Dunn 113)

9:30–9:45 Stephanie Béland: St. Mary’s University
Which Whales Were Hunted? Genetic Analysis of Bones from Traditional Whaling Sites on Vancouver Island

9:45–10:00 Eric Rideout: University of New Brunswick, Fredericton
Localization of a glycosylated reproductive protein from a parasitic nematode with a potential role in evasion of host immune responses

10:00–10:15 Andrew Cowie: University of New Brunswick, Saint John
Sub-Network Enrichment Analysis identifies MAP3K1 signalling as a target of the herbicide LIN in *Pimephales promelas* ovary

10:15–10:30 Joushua Lee: Dalhousie University
The duplicated cellular retinoic acid-binding protein genes and tissue-specific distribution of their transcripts in adult medaka (*Oryzias latipes*), the Japanese rice fish

10:30-10:45 Beth Whitfield: Mount Allison University
The effect of DCA and allopurinol on cancer incidence and progression in *Drosophila melanogaster*

11:00 – 11:30 Joint Break (Tweedie Hall)

11:30 – 12:30 Keynote speaker – Dr. Paul Snelgrove, Memorial University (Dunn 113)
Marine Biodiversity in the 21st Century; Making Ocean Life Count

12:30 –13:30 Lunch and awards (Jennings Hall)

Abstracts: Oral presentations

Which Whales Were Hunted? Genetic Analysis of Bones from Traditional Whaling Sites on Vancouver Island

Stephanie Béland
(St. Mary's University)

Archaeological evidence and oral history suggests that active whale hunting by the Nuu-chah-nulth First Nations of Vancouver Island is a large part of their traditional culture. What is not clear is which species was the preferred target. Some data suggest that the primary target was gray whales (*Eschrichtius robustus*), whereas other sources of information suggest that the hunt targeted a mixture of gray and humpback whales (*Megaptera novaeangliae*). Addressing this issue is of increasing importance due to the interest of some traditional groups in resuming their hunts, now that these two species are recovering from industrial whaling. Here, we address this issue through the genetic analysis of bones recovered from historic whaling sites. Samples were collected from a range of sites, the DNA was extracted, and species identification was based on sequence analysis of two regions of the mitochondrial DNA (the control region and cytochrome *b* gene). We were able to successfully obtain DNA from ~90% of the bones, and the data suggest an approximate 50:50 ratio of gray and humpback whales in the traditional hunts. While further sampling, across a wider range of traditional sites, is needed to address regional difference in preferred species, these data demonstrate the great promise of this approach for informing management decisions regarding the resumption of these traditional hunts, and will also lead to an improved understanding this aspect of Canadian history and culture.

Sub-Network Enrichment Analysis identifies MAP3K1 signalling as a target of the herbicide LIN in *Pimephales promelas* ovary

Andrew Cowie, Anna Ornostay, & Dr. Christopher J. Martyniuk
(University of New Brunswick, Saint John)

The investigation of linuron (LIN), a ureic-based herbicide, has yielded diverging evidence on its mode of action (MOA) in fathead minnows (FHM, *Pimephales promelas*) ovary. Current research on LIN has demonstrated anti-androgenic, anti-estrogenic and estrogenic MOAs for LIN. The objective of this study was to investigate molecular pathways that are altered by LIN to support a specific MOA. The ovaries of FHM were exposed to three concentrations of LIN (250 µg/L (10^{-6} M), 25 µg/L (10^{-7} M), and 2.5 µg/L (10^{-8} M)) *in vitro* in a 12 hour incubation experiment. Microarray analysis was performed and sub-network enrichment analysis identified the expression target of mitogen-activated protein kinases kinases kinases 1 (MAP3K1) and its measured neighbours (VDR, PRDX1 and MMP9) as being a pathway significantly affected by LIN. This pathway is also regulated by androgens. MAP3K1 and its neighbours were further analyzed using real-time PCR for gene expression differences. This study characterizes gene cascades in the ovary that are impacted by aquatic pollutants such as the herbicide linuron.

Effect of size of ewes and various placental components on lamb growth

Samuel D. Cripps & Dr. David M.W. Barrett

(Nova Scotia Agricultural College)

Predicting which lambs will grow better despite dam characteristics will be useful for sheep producers. Previous studies in humans have shown that cord length had a positive correlation with maternal height, foetus being male and pregravid weight, but nothing has been found in the ovine species. The objective of this study was to determine if there were any correlations among lamb growth, ewe size, and placental components. Time of lambing, sex, umbilical cord length (lamb and placental cord length connected), placentome weight (PW), hip and shoulder height and body weight were determined from 19 singleton lambings out of 40 bred ewes. The ewes were either primiparous Arcott Texel or multiparous variation of breeds (one to four). Ewes were all bred to a single Texel ram and introduced as a flock. The ewes ranged from one to six years of age. PW was strongly and positively correlated to lamb weight (0.606,0.793), multiparous ewes (0.750) and ewe weight (0.591), but strongly and negatively correlated to gestation length (-0.635)(<0.05). Gestation length and placental cord length were also strongly and positively correlated (0.731)(<0.05). Ewe weight before and after lambing was strongly and positively correlated to lamb weight (0.728,0.671,0.547,0.613). Multiparous, heavier ewes, and heavier lambs had a larger PW, but longer gestation length resulted in a longer placental cord length and smaller PW. Larger ewes produced larger lambs. There is no significant connection to results found in humans but with a larger sample size and more data collected a relationship could be determined.

***Coronilla varia* (Crown Vetch) as an Invader of Mahoneys Beach, Antigonish, Nova Scotia**

Andrea Flynn

(St. Francis Xavier University)

Coronilla varia (Crown Vetch) has been planted in Nova Scotia and other parts of North America for roadside stabilization. *C. varia* has been recognized as an invasive species in other parts of North America, but never in Nova Scotia. Recently, *C. varia* has been observed on one sand dune, barrier beach system, Mahoneys Beach, in Antigonish County. Here, I assess the invasiveness of *C. varia* on Mahoneys Beach and possible mechanisms for its success in this ecosystem. Monospecific clumps of *C. varia* occupy 8% of the whole dune system but account for 32% of the area in the zone where *C. varia* occurs. In competition experiments carried out on Mahoneys Beach, *C. varia* had negative impacts on certain growth characteristics of native plant species ($p < 0.1$). Possible mechanisms for the success of *C. varia* on Mahoneys Beach were hypothesized to be shading of native plant species, or extensive root systems. Shading is not likely the mechanism since irradiance levels beneath the canopy of *C. varia* were highest ($565 \mu\text{mol}/\text{m}^2/\text{s} \pm 69$), compared to irradiance beneath native species. However, root systems of the four dominant native plant species were shallow (approximately 20 to 30 cm), while *C. varia* had an extensive root system which extended down more than 90 cm. This indicates that the deep root system of *C. varia* provides a possible mechanism for its success on Mahoneys Beach. This is the first description of *C. varia* as an invasive coastal sand dune species in Nova Scotia.

Listening in the Fast Lane: Detecting Harbour Porpoise Activity in the Minas Passage

Lauren Fogarty, Dr. Anna Redden & Dominic Tollit¹
(Acadia University; ¹Sea Mammal Research Unit, UK)

The Bay of Fundy and many other macro-tidal coastal waters are currently sites of interest and development activity for harnessing tidal energy. However, there is currently little understanding of the effects of tidal turbines on the behavior of marine animals, in particular fish and mammals. The Fundy Ocean Research Center for Energy (FORCE) is testing turbines in the Minas Passage and addressing their impacts on the environment. Current research in the Minas Passage includes examination of the presence and activity of Harbour porpoises (*Phocoena phocoena*) to address questions related to potential impacts including risk of harm to porpoises inhabiting the area. We are using passive acoustic monitoring devices (C-PODS) to detect porpoise click trains (i.e. activity) of these highly vocal animals. Three units were positioned in the FORCE test area from August to November 2010 and from May to August 2011. The goal of this study was to characterize the spatial and temporal baseline activity of Harbour porpoises, and porpoise activity associated with current speed (up to 4 m/s). Porpoises were present on all days (May-Nov), with peak activity in late June. Significant differences were detected between sites. As found elsewhere, there was significantly greater porpoise activity during the nighttime than during daytime. Relatively low levels of detection were observed at high current velocities (>2 m/s) and C-PODS recorded significantly more detections during the ebb tide phase than during the flood tide. This may be a behavioral response but could also be an effect associated with turbulence-induced detection interference.

Effects of temperature and tidal exposure on survivorship and behaviour of *Corophium volutator*

Christine E. Gilroy. & Dr. Diana J. Hamilton
(Mount Allison University)

The amphipod crustacean *Corophium volutator* is a sediment-dwelling resident of intertidal mudflats in the upper Bay of Fundy, and is a primary food source for many demersal fishes and migratory shorebirds. The behaviour of these amphipods is thought to be influenced by foraging of shorebirds, though increased temperatures during the period when shorebirds are present may also play a role, and it is difficult to disentangle these factors in the field. It is important to know how *Corophium* respond to increased temperature because future climate change may affect both them and their availability as prey. To address this knowledge gap, we investigated the effect of increased temperature on 1) *Corophium* crawling behaviour following tidal recession 2) their vertical distribution within the sediment and 3) survivorship. We conducted a series of 3-day laboratory trials in which *Corophium* were exposed to specific temperature treatments. Throughout trials we recorded surface activity daily. After each trial, sediment cores were taken to assess the vertical profile and survivorship of *Corophium*. Results indicate that increased temperature leads *Corophium* to reduce crawling activity and move deeper into the sediment. Further, *Corophium* ceased crawling sooner after exposure in warmer temperatures, and survivorship was substantially reduced in warmer treatments. This suggests that on hot summer days *Corophium* may be less available as a prey item to migratory shorebirds relying on them. Increasing sediment temperatures in future may also negatively affect *Corophium* populations, leading to community-wide changes and additional stress for species that rely on these invertebrates for food.

Re-description of *Captorhinikos valensis*, a fossil reptile from the Permian of Texas

Amy Lamb

(Cape Breton University)

The family Captorhinidae is a group of early reptiles with a temporal range that extends from the Late Carboniferous to the Late Permian (ca. 300 to 260 million years ago). The family had its greatest species richness during the Early Permian, but evidence suggests the family became extinct before the end of the Permian (ca. 252 million years ago). Captorhinids are indispensable taxa in the study of basal amniotes because they are a relatively long-lived group, and they exhibit evidence of the acquisition of herbivory; this makes them important components in the initial formation of terrestrial vertebrate ecosystems of modern aspect. *Captorhinikos valensis* is a small, herbivorous Early Permian captorhinid species described by Everett Olson in 1954. Current morphological information on *C. valensis* is based on a single partial jaw (the holotype) and 7 additional specimens (listed by Olson but not thoroughly described or illustrated). I examined the holotypic jaw and the anatomically informative specimens in order to restudy this taxon. *Captorhinikos valensis* shares derived characteristics (apomorphies) of the main dentition with the large herbivorous captorhinid *Labidosaurikos meachami*, but differs in featuring a more heavily toothed palate. No uniquely derived characters (autapomorphies) are evident (which would help to validate *C. valensis* as a species), and vertebral anatomy indicated immaturity at death. I added *C. valensis* to a previously published data matrix for captorhinids in order to investigate its relationship within the family.

Seasonal variation in the symbiont abundances of thyasirid clams (Bivalvia: Mollusca) from Bonne Bay, Newfoundland

Jason Laurich & Dr. Suzanne Dufour

(Memorial University of Newfoundland)

The Thyasiridae represent an unusual family of chemosymbiotic bivalves, displaying a remarkable degree of variation in reference to nutritional strategy and crucial evolutionary adaptations to symbioses with chemoautotrophic bacteria. This unusual amount of inter-specific variation manifests itself even on a sub-genus level in the genus *Thyasira*, wherein only some species of thyasirids possess symbionts. In addition to this inter-specific variation, investigations of symbiotic thyasirids have demonstrated significant variation in host nutritional strategy and symbiont abundances in relation to environmental parameters such as particulate organic matter and sulphide availability. To date, however, there has been no systematic investigation of the possibility of seasonal variation in the abundance of chemosynthetic bacterial symbionts in the thyasirids or any other group of chemosymbiotic bivalves. Here, the possibility of seasonal variation in the symbiont abundances of thyasirid clams was investigated in populations found in Bonne Bay, Newfoundland. In the species *Thyasira aff. gouldi*, histological examination of specimens uncovered substantial evidence that this species undergoes profound seasonal variation in its nutritional reliance upon its symbiont populations, which are at a minimum in the spring and peak in the late summer. Bacterial abundances remain high throughout the late fall, presumably followed by a gradual decline in symbiont populations. In thyasirids, this seasonal variation in symbiont abundance is likely related to variation in access to reduced sulphur species and particulate organic matter in Bonne Bay.

The duplicated cellular retinoic acid-binding protein genes and tissue-specific distribution of their transcripts in adult medaka (*Oryzias latipes*), the Japanese rice fish

Joshua J.A. Lee & Dr. Jonathan M. Wright
(Dalhousie University)

Many genes in teleost fishes are duplicated owing to a whole genome duplication event that occurred ~230 million years ago. We were interested to determine the fate of duplicated cellular retinoic acid-binding protein (*crabp*) genes in medaka. *Crabps* bind and transport retinoic acid, a derivative of vitamin A, which plays an important role in vertebrate development. The objectives of this study were: (1) to determine if two copies of the *crabp1* and *crabp2* genes are present in the medaka genome as has been observed for zebrafish; (2) whether they show the same patterns of tissue-specific regulation. Genomic and cDNA sequences coding for the cellular retinoic acid-binding proteins, *crabp1a*, *crabp1b*, *crabp2a* and *crabp2b*, in medaka were obtained from DNA sequence databases. Protein sequence identity and phylogenetic analysis indicated that the *crabp* genes of medaka were the orthologs of the zebrafish *crabp* genes. Conserved gene synteny exists between the medaka *crabp* genes and the *crabp* genes of zebrafish, human, rat and mouse, indicating that these duplicated genes likely arose owing to a whole genome duplication. The tissue-specific distribution of *crabp* gene transcripts in adult medaka was determined by reverse transcription polymerase chain reaction in eleven tissues. *crabp1a* transcripts were detected in all tissues except heart and swim bladder, *crabp1b* transcripts in all tissues except swim bladder, while *crabp2a* and *crabp2b* transcripts were detected in all tissues. With additional data to be derived from zebrafish, these results will provide insight into the genesis and fate of the duplicated *crabp* genes in teleost fishes.

A sequence of events: unraveling the story behind an algal-vertebrate symbiosis

Annie Livingstone
(St. Francis Xavier University)

Embryos of the northeastern yellow spotted salamander *Ambystoma maculatum*, form an ectosymbiotic association with the green alga, *Oophila amblystomatis*. A similar ectosymbiotic interaction is also known to occur in several other amphibian species. Recent observation of *A. maculatum* embryos from a population near Halifax, Nova Scotia revealed that these green algae invade the tissues and even cells of the salamander embryos constituting the first documented case of a vertebrate-algal endosymbiosis (Kerney et al. 2011). Several basic questions pertaining to this and other symbiotic interactions remain unanswered. I have attempted to answer two of these questions. Is *Oophila* the only species of green algae associated with *A. maculatum* embryos and does *Oophila* participate in associations with the wood frog *Rana sylvatica* and the northwestern salamander *Ambystoma gracile*, two other amphibians known to have ectosymbiotic algae? These hypotheses were tested by molecular genetic analyses of algal samples harvested from egg masses. Samples of algae associated with *A. maculatum* egg masses were obtained from several sites in Nova Scotia as well as those from selected egg masses of *A. gracile* and *R. sylvatica*. Both 16s and 18s ribosomal DNA were PCR amplified, cloned and sequenced. Sequences were then aligned with known green algal outgroups and relationships were inferred using phylogenetic reconstruction. The sequence variation that we observed among algal samples from different *A. maculatum* populations as well as populations of closely-related amphibians was low, suggesting a surprisingly close relationship among algae from these different amphibians. This similarity at the sequence level provides us with insight into the evolutionary origin of this symbiotic interaction.

Humeral Bone Health in Laying Hens (*Gallus gallus domesticus*) Housed in Conventional and Furnished Cage Systems: Does Expression of Wing-Loading Behaviour Contribute to Bone Strength?

J.L. Lutes, K.M. Frizzell, & Dr. M.J. Jendral
(Nova Scotia Agricultural College)

Restricted movement in conventional battery cages contributes to osteoporosis and a high incidence of humeral fractures in laying hens. This study was conducted to assess the influence of wing-loading behavioural expression on humeral bone strength in Lohmann Lite (LL), Lohmann Brown (LB), and Shaver White (SH) hens housed in Conventional (CC) (60cm X 55cm) (n=24 cages/strain; 5 hens/cage) and Furnished (FC) (110cm X 240cm) (n=4 cages/strain; 40 hens/cage) cages. Hens in FC had access to a nestbox, hardwood perches, and an elevated dustbath, in addition to the 660 cm²/hen floor space allocation. Video footage of all FC and 27 CC (9 cages/strain) was recorded (58 weeks), for a 3-hour period beginning at dustbath opening. Continuous behavioural sampling was conducted for 10-minute intervals each hour to assess wing flap, wing/leg stretch, jumping, and flying frequencies. At 80 weeks, hens were euthanized and right humeri (n=9 CC/strain; 3 hens/CC; n=4 FC/strain; 6 hens/FC) were excised and assessed for bone breaking force (BBF). Data were assessed for normality, transformed where required, and analyzed using the PROC Mixed procedure of SAS. Significance was accepted at $P \leq 0.05$. Bone findings indicate that for all strains, BBF was higher in FC than CC ($P < 0.05$). LB hens also had higher BBF than LL and SH hens in both CC and FC ($P < 0.001$). Behavioural findings will confirm whether expression of wing-loading activity was elevated in FC and contributed to improved humeral bone integrity. These findings highlight the significant contribution of housing environment to hen health and welfare.

Identification of Halophilic Protozoa via Environmental PCR

Karissa Milbury
(Dalhousie University)

Protozoans represent the vast majority of the eukaryotic predators in extremely hypersaline systems – environments exhibiting sodium chloride concentrations exceeding 30%. Although classification of these organisms began several decades ago, there are several problems with the traditional identification techniques. Many require the species to be grown in culture first, which is not always possible as the environmental conditions may not be reproducible in the lab. In addition to *in vitro* competition for nutrients, this creates a situation where some species are lost prior to the identification process. Using traditional microscopy, species may also be misidentified due to structural homoplasies. For these reasons, a culture-independent, DNA-based method is preferable.

This project aimed to optimize the environmental PCR technique for use in identification of halophilic protozoans in field samples. This eliminates the need for culturing, and allows direct assessment of DNA content within field samples. This technique poses an additional problem of over-representation of highly prevalent species, in particular the chlorophyte green algae *Dunaliella salina*. For this reason, this PCR involved the design of primers biased against the Chlamydomonadales, the group including *Dunaliella*, to allow the detection of rarer halophilic eukaryotes. By comparing the species identified via environmental PCR and amplicon sequencing to those identified by traditional culture-based methods, this project aimed to validate prior diversity estimates and potentially identify novel halophiles that have eluded discovery through past methods.

Role of parental age on European starling (*Sturnus vulgaris*) Brood sex ratios

Alexandra Ouedraogo
(Saint Mary's University)

In sexual selection in monogamous and polygynous social systems, female birds choose to mate with high quality males who display conspicuous ornaments. In many species, ornaments are related to age and age is often positively associated with quality of parents (reproductive performance, parental care, etc.). Additionally, many avian studies have shown an adjustment of primary brood sex ratio with parental quality; high-quality mates produced a male-biased sex ratio. The length of throat feathers in European starlings (*Sturnus vulgaris*) has been documented as a good indicator of age and sex. Parents with longer throat feather were older which indicated better quality. The goal of this study is to evaluate the role of parental age on brood sex ratio. I hypothesized that throat feather length (age) has an effect on brood sex ratios. Therefore, if brood sex ratio is dependent on parental quality, then older parents should have a male biased brood sex ratio. Findings should provide a better understanding of primary brood sex ratios and factors affecting it.

Effects of immunostimulatory feeds on atlantic salmon (*Salmo salar*) responses to sea lice (*Lepeophtheirus salmonis*) infection

Jordan D. Poley, Sara L. Purcell, Dr. Lawrence Hale, Dr. Robert Hurta & Dr. Mark D. Fast
(University of Prince Edward Island)

This study was conducted to determine the effect of various immunostimulatory feeds on the immune response in Atlantic salmon and subsequent infection with the parasitic copepod *Lepeophtheirus salmonis*. Atlantic salmon were divided into three different feed groups (Signature Corey control feed, 2% Aquate®, and 2 g/1000 kg CpG ODN) and salmon were exposed twice to *Lepeophtheirus salmonis* copepodids. Interleukin-1 β expression levels were monitored before *L. salmonis* exposure and at 3 time points after; 6, 13, and 26 days post final exposure (dpfe). Plasma cortisol levels and *Lepeophtheirus salmonis* attachment were also monitored at all sampling times, with a final sampling done at 33 dpfe. Prior to *Lepeophtheirus salmonis* exposure, interleukin-1 β was shown to be significantly higher in both immunostimulant feeds as compared to the control feed, however no significant difference was seen between the feeds post infection. Cortisol levels were found to increase significantly in the 2% Aquate® group 6 dpfe while other feeds remained similar over time. Lice attachment was found to decrease significantly in all groups over time, in some cases reaching 61% overall reductions. There were no significant differences between groups over time however when correcting for initial infection intensity in all groups, the Aquate and CpG fed groups were observed to have a 19% greater decrease in lice numbers compared to the control.

The changing Bumble Bee (Hymenoptera: Apidae: *Bombus*) fauna of Cape Breton Island, Nova Scotia

James Postlethwaite
(Cape Breton University)

Bumble bees, the large, familiar furry bees, are attracting conservation interest because of declining populations and shrinking geographic ranges in North America, for the last 20 years, and Europe, for the last 60 years. Recently the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed *Bombus affinis* as endangered and is now considering *B. terricola* and *B. occidentalis*. In the past 20 years other species, such as *B. impatiens*, which are used extensively in greenhouse pollination, have expanded their geographic range and became one of the most abundant bumble bees in the Maritime Provinces. Here I will document the changes in relative abundance and phenology of the 13 bumble bees on Cape Breton Island using the Cape Breton University insect collection. Although *B. terricola* and *B. fervidus* have declined in relative abundance since the early 1990's, *B. impatiens*, *B. vagans* and *B. citrinus* have increased in relative abundance in the same time period.

Localization of a glycosylated reproductive protein from a parasitic nematode with a potential role in evasion of host immune responses

Eric Rideout, Jen Fitzpatrick & Dr. Mike Duffy
(University of New Brunswick, Fredericton)

Adult *Parelaphostrongylus tenuis* have been shown to survive within white-tailed deer for the lifespan of their host. Molecular interactions at the host parasite interface are poorly understood but immune modulation clearly facilitates parasite survival. A subset of proteins secreted from adult parasites are modified with a glycan called alpha-gal. This disaccharide is of interest in the context of the host-parasite relationship because it is observed commonly on cells of the deer host. Accordingly, alpha-gal might be used by the parasite for immune evasion. Alpha-gal is found only in the adult stage of the parasite and it is restricted further to the excretory glands and within the uterus of female worms. Alpha-Gal was localized to the uterine contents surrounding eggs using an anti-Gal monoclonal antibody (mAb) in immunohistochemistry. While numerous secreted proteins are modified by alpha-Gal, Western blots using the anti-Gal mAb revealed that only one protein from the reproductive tract harbours this alpha-Gal epitope. Immunogold labeling further localized the alpha-Gal epitope to an electron dense material within the uterus. Whereas this material and the alpha-Gal epitope surrounded the external surface of eggs in situ, alpha-gal was not associated with eggs following their release. While a putative role in immune evasion is supported, the alpha-gal epitope does not coat eggs to promote molecular mimicry. Subsequent work will aim to identify specifically this alpha-Gal-modified and reproductive-associated protein using tandem mass spectrometry to help infer function.

Screening for Antimicrobial Extracts from Marine Algal Endophytes

Joseph Sanford, Dr. Christopher A. Gray & Dr. John A. Johnson

(University of New Brunswick, Saint John)

The increasing occurrence of drug resistant pathogenic microbial strains has resulted in an urgent need to discover new antibiotics with novel modes of action. Historically, natural products have been by far the most successful source of drugs for both infectious and non-infectious diseases. Endophytes have been identified as a promising source of bioactive compounds, and endophytes of marine algae represent a relatively un-tapped source of chemical diversity. As such, the goal of our research is the isolation of new antibiotic compounds from marine algal endophytes for the discovery and development of new anti-infective therapeutic agents. A total of 183 endophytic fungal isolates have been obtained from 14 species of marine algae from the Bay of Fundy, NB. These isolates have subsequently been cultured in liquid media and crude fungal extracts have been prepared using small scale liquid extraction. The crude extracts were screened for antibiotic activity against Gram positive and Gram negative bacteria and fungi. A total of 24 extracts displayed antibiotic activity in our microplate assay, with 17 inhibiting the growth of Gram positive bacteria and 7 displaying antifungal activity. Surprisingly, none of the extracts inhibited the growth of Gram negative bacteria. We have shown that chemical extracts from marine algal endophytes represent an important source of antibiotic compounds. Further work will focus on the bioassay guided fractionation, isolation and identification of the chemicals responsible for the observed activity of the crude extracts.

Assortative mating by size in Atlantic puffins (*Fratercula arctica*)

Rebecca Ann Standen & Dr. A. W. Diamond

(University of New Brunswick, Fredericton)

Atlantic puffins (*Fratercula arctica*) are sexually monomorphic, monogamous seabirds, both the male and female being ornamented. Since both male and female are ornamented and provide parental care, there may be choosiness from both the male and the female during sexual selection, in contrast to other bird species where only the female does the choosing. If both male and female puffins are involved in mate choice, then we might expect to see puffins mate assortatively by size of ornaments, or by structural measurements, possibly indicating age. For this biometric study of assortative mating in puffins, 69 mated pairs were captured on Machias Seal Island. Sex of the birds was determined by discriminant analysis of measurements and DNA analysis. Bill, mass and wing chord measurements of the male were compared to the female measurements in each pair to determine if there is a correlation between male size and female size. Puffins mate assortatively by all of the morphometric measurements tested (culmen, bill depth, headbill, wing chord, mass, rosette length, and rosette width) though the effect size is small.

Photophysiology of *Bolidomonas pacifica* L.Guillou & M.-J.Chrétiennot-Dinet

Sara Thomas, Dr. David Kristie, & Dr. Douglas Campbell¹
(Acadia University; ¹Mount Allison University)

Bolidomonas pacifica is a chlorophyll a/c marine phytoplankter in a sister lineage to the more widely distributed diatoms. Marine diatoms thrive under conditions of fluctuating light, so we sought to characterize the photophysiology of *B. pacifica*, and its responses to upward fluctuations in light. We grew *B. pacifica* under six light levels between 30 to 450 $\mu\text{mol photons}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, a range spanning the bottom 10% of the photic zone up to the near-surface top 30% of the photic zone. The cells achieved maximum growth at 250 $\mu\text{mol photons}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, equivalent to the middle of the photic zone. Light capture measures for PSII photochemistry were much larger than in marine diatoms, and *B. pacifica* did not show acclimatory changes in these light capture measures across cells grown from low to high light. When analyzing *B. pacifica* responses to mixing through the water column, we found that within 15 minutes of being shifted to a higher light, *B. pacifica* cultures with active PSII repair cycles induced PSII repair, thus stabilizing PSII function in the face of accelerated photoinactivation. When we used a chloroplast protein synthesis inhibitor (lincomycin) to block PSII repair, the cells suffered progressive loss of PSII function, with a susceptibility to photoinactivation about double that of marine diatoms under comparable conditions. Thus a rapid induction of metabolically expensive PSII repair is necessary for *B. pacifica* to withstand upward mixing through the water column. We hypothesize these differences result from the lack of the siliceous frustule that modifies the optics of their diatom cousins.

The effect of DCA and allopurinol on cancer incidence and progression in *Drosophila melanogaster*

Elizabeth Whitfield

(Mount Allison University)

Cancer cells are metabolically abnormal, a property that can be exploited by chemotherapeutic agents. Some cancer cells exhibit altered glycolytic energy metabolism, known as the Warburg effect. While normal cells use their mitochondria for cellular respiration and only employ cytoplasmic glycolysis when oxygen is limiting, many cancer cells undergo cytoplasmic glycolysis even when oxygen is available. The reduced use of mitochondrial oxidative phosphorylation in these cancer cells can offer a target for treatment of cancerous cells, an approach called metabolic remodelling.

Dichloroacetic acid (DCA) and allopurinol are nonproprietary drugs used to treat mitochondrial diseases and gout, respectively, however it has been recently found to be able to suppress tumours by altering mitochondrial activity. Although these treatments are currently being used to treat cancer in an unregulated fashion, the cellular biology behind their biological effects has not been well studied. Therefore, we tested the effects of these drugs on tumour proliferation were tested on two tumour-possessing strains of *Drosophila melanogaster*, *tu(sz)* and *hop^{tum}*. It was found that DCA caused a significant decrease in *Drosophila* tumour proliferation, although the different types of tumours responded differently. Allopurinol alone does not appear to have effect but may act only in combination with DCA. By testing the effects of these drugs on a model organism we can learn more about how these drugs work and explore novel, and potentially more selective, approaches to eliminating cancer cells.

Abstracts: Poster presentations

The Effect of Cold and Anaerobic Conditions on Northern Killifish

Katelyn Barnes
(St. Francis Xavier)

Chloride cells in the opercular epithelia (OE) of the euryhaline, euryoxic, and eurythermic killifish (*Fundulus heteroclitus*) actively secrete chloride, an energetic process that can be easily measured electrophysiologically as short circuit current (I_{sc}). In this experiment, the response of I_{sc} to decreasing temperature from 30°C to 0.2°C was measured in OE from warm (20°C) and cold (5°C) acclimated fish in aerobic (99% O₂ sat.) and anaerobic (NaCN 0.5mM; N₂ sat.) conditions. We found that the chloride transport in warm acclimated fish was supported mostly (75%) by aerobic metabolism, whereas that of cold acclimated fish was instead more anaerobic. There is a critical temperature, 8°C, below which aerobic I_{sc} drops sharply, suggesting a shift in efficiency in oxidative phosphorylation. From this it was determined that, once acclimated to cold, chloride cells are incapable of increasing their aerobic ATP supply, even when warmed to 30°C. The large aerobic scope of warm acclimated fish favors active foraging at high temperatures, while the low aerobic scope of cold acclimated fish is appropriate to low metabolic levels, anaerobiosis and inactivity.

The Effects of *Wolbachia* Infection on the *Drosophila* Epigenome

Amy Brown
(Mount Allison University)

Epigenetics is the study of heritable changes in gene expression controlled by factors other than the sequence of the genes themselves. These factors are often environmental, and include endobacteria, bacteria that live within the cells of many eukaryotes. Epigenetic gene expression is changed by altered chromatin packaging; euchromatin is loosely packed chromatin associated with higher gene expression and heterochromatin is tightly packed chromatin associated with lower gene expression. Euchromatin and heterochromatin are maintained and controlled by numerous chromatin proteins. Endobacteria such as *Wolbachia*, a relative of mitochondria, are known to cause changes in gene expression in the host organism, in some cases killing or sterilizing the host. The mechanism responsible for these changes is unknown. My research is to test the hypothesis that *Wolbachia* are able to induce influence the host genome by hijacking epigenetic regulators from the host nucleus. My results indicate that *Drosophila* infected with the endobacterium *Wolbachia* have an altered epigenetic state manifested in disrupted gene expression. This indicates that *Wolbachia* can alter host gene expression and demonstrates a mechanism by which endobacteria affect host epigenetics. This work provides an insight into the initial stages of endosymbiosis, the process leading to the evolution of all eukaryotic cells and is also significant as all eukaryotes, including humans, harbour a variety of intracellular bacteria, symbiotic, parasitic and neutral, with largely unknown effects on the host genome.

Beef Cattle Management in Atlantic Canada

J. Dowe & Dr. J. Small

(Nova Scotia Agricultural College)

A survey was administered to beef producers in Atlantic Canada to identify present management systems, factors limiting the profitability of producers in the region, and areas where producers feel future research needs to be directed. Geographical regions were identified in each province; 5 in Nova Scotia, 4 in New Brunswick, 3 in Prince Edward Island and 3 in Newfoundland and Labrador. A total of 23 questions were included in the survey, and focused on characterizing the farm operation, reproductive management, feeder cattle management, pasture & dietary management, and factors affecting profitability/areas for future research. A response rate of 60 to 75 producers (30% of the population to whom the survey was made available) was expected. Data were subjected to categorical analyses using SAS PROC LOGISTIC, with a p value of 0.05 or less being accepted as significant. Correlations were examined between profitability and diet, as well as profitability and allocation of cattle. Products differed among regions; 52% sold weaned calves with the exception ($P < 0.05$) of PE where slaughter cattle were the main product. Costs of beef production, namely feed costs and price paid, and herd size were the most frequent factor(s) limiting profitability. Suggested areas of future research that could potentially improve profitability include grass-fed beef production, feed efficiency, and genetic selection to make retaining breeding stock more profitable.

Effects of Morphine Exposure on Lung Surfactant: Increased Vulnerability to ALI?

Elizabeth Faour, Dr. Karen Brebner, Jen Morgen & Dr. Angela Beye

(St. Francis Xavier University)

Background: Abuse of prescription drugs, such as morphine, is becoming increasingly prevalent in today's society. Previous studies have provided evidence that chronic alcoholism predisposes the lung to Acute Lung Injury (ALI) by altering the lungs. Specifically, it unfavourably alters the composition and production of lung surfactant, a substance that lines the lungs and functions to prevent lung collapse. Due to similarities between the alcoholic lung and narcotic lung, we hypothesized that chronic morphine exposure and/or withdrawal will negatively alter lung surfactant composition and production. This will result in an inflammatory response and a decrease in lung function, predisposing the lungs to ALI.

Methods: To test this hypothesis, we exposed Sprague-Dawley rats (*Rattus norvegicus*) to morphine sulfate as a mammalian model of drug abuse. Subsequently, the lungs were lavaged and surfactant was quantified to observe changes in pulmonary surfactant composition. Cells recovered in the lavage were counted to assess lung inflammation, and pressure-volume analysis measured lung compliance, indicative of lung function. **Results:** After chronic exposure to morphine, we observed unfavourable alterations in surfactant composition, and increased lung compliance, which both persisted through a withdrawal period. No signs of inflammation were observed. Aside from the altered surfactant composition, these results are contrary to our hypothesis that lung function would be decreased and that an inflammatory response would result. **Conclusion:** Chronic morphine exposure has a significant effect on lung surfactant, but further studies are necessary to conclude whether it predisposes the lungs to ALI.

Microaerophilic amoebae and their role in the soil ecosystem

William Kirby
(Dalhousie University)

Soils have microaerophilic compartments that are inhabited by bacteria which thrive in low oxygen environments; some of these bacteria produce greenhouse gases as part of their metabolism. The community structure of these greenhouse gas producing bacteria are influenced by predation from protists. The purpose of this study was to determine if there were protists specialized to live in the microaerophilic spaces, and if so, to learn something about their identity and biology. Soil was collected from Point Pleasant Park, and small samples were cultured in a microaerophilic environment and in an aerobic environment. Two different amoebae were shown to thrive in a microaerophilic environment while not thriving in the aerobic environment. One of the amoebae isolated was of an unknown genus, which was submitted to transmission electron microscopy to aid in description, while the other was of genus *Deuteroamoeba* sp. Both amoebae cultures were prepared for DNA sequencing to reveal their taxonomic identity and we await the results. Each amoeba was then placed on a haemocytometer with bacterialized medium, and their feeding rates recorded to form a functional response curve. It was expected that both of the amoebae would exhibit a type II functional response, although type III responses are known to occur in protist bacterivores. This data will provide an indication of the grazing impact of these amoebae on bacterial communities. Subsequent studies would address to bacteria community structure caused by these microaerophilic amoebae.

Effects of obesity related hormones on testosterone production in the testis

David Landry & Dr. Luc J. Martin
(Université de Moncton)

With 29% of the population with a body mass index above 25, New Brunswick is the province where the obesity rate is the highest in Canada. Adipose tissue is an endocrine organ that produces various hormones, including leptin and adiponectin. Obesity in humans is associated with decreased fertility by reducing testosterone production and total sperm count. This project aims to study the effects of adipose-derived hormones on testosterone production in Leydig cells from the testis. Our results demonstrate an inhibition of the transcription and translation of genes important for testosterone production, including StAR and Cyp11a1. Our results support previous findings showing that leptin has a inhibitory actions on StAR and Cyp11a1 expressions in the testis. For adiponectin, a novel role in the regulation of testosterone production in Leydig cells is established. Our data demonstrate a inhibitory action of adiponectin on StAR transcription in these cells. To support a direct action of these hormones on Leydig cells, we characterized the expressions of the leptin and adiponectin receptors in such cell lines. Thus, these results will contribute to better assess the consequences of obesity in our society.

Downstream changes in a midge (Diptera: Chironomidae) community in a limnocrene spring in Prince Edward Island

Qi Liu, Kyle M. Knysh & Dr. Donna J. Giberson
(University of Prince Edward Island)

Midges (Diptera: Chironomidae) are frequently the most abundant group of insects in freshwater ecosystems. However, they have been poorly studied in cold spring habitats. Springs contain uniquely adapted organisms that differ from regular stream systems due to their hydrologic, thermal and chemical stability over time. The goal of this research is to examine the biodiversity of chironomids in a spring in eastern Prince Edward Island (PEI) and how the community changes from a limnocrene spring source (Pool) to the spring brook approximately 10 metres downstream. Larval and adult chironomids were collected in summer 2012 using a Hess sampler and emergence traps, respectively. Then larval chironomids were sorted out from benthic samples and identified to genus. We found 18 genera in the spring head, 20 genera in the brook and 24 genera in total in the spring-brook ecosystem. There was a difference in the midge community structure between the spring source and the spring brook, and the abundance was much higher in the spring source than in the spring brook for those genera that were in both the spring head and the spring brook. Patterns will also be explored at the species level, when identifications for the adult specimens are complete, to determine whether the same patterns are seen at both levels of taxonomic resolution. In all, this project produced a primary record of chironomids in springs in PEI and indicated that spring source and spring brook are unique and discrete microhabitats.

Dynamic Properties of Carbon Dioxide Transduction by *Drosophila* Antennal Sensilla

Jenai Lowe
(Dalhousie University)

Olfactory sensation is a dynamic process, resulting from a combination of anatomical and physiological constraints with environmental pressures. The dynamics of sensory systems are often described in terms of input–output frequency response functions. While such measurements have proven widely useful in the field of sensory neuroscience, their application to olfactory sensation has been limited by the difficulties of controlling and measuring dynamic olfactory stimuli. The current project takes advantage of recent developments that allow olfactory stimulation with relatively lownoise, linear, and wide frequency range properties, to characterize the transduction of carbon dioxide by *Drosophila* antennal sensilla.

Olfactory stimulation was delivered by a fan-driven laminar airflow system through a 1 cm diameter plexiglas tubing (the flow tube). Carbon dioxide was added to the flow simultaneously with 1,000 ppm propylene tracer gas in air at the center of the flow tube via two electromagnetic valves. The valves were driven by a maximum-length random binary on-off sequence from a computer to create a wide bandwidth stimulus. Tracer gas was detected by a photoionization detector (PID) located immediately adjacent to the *Drosophila* antenna. Single-unit neural recordings were obtained by placing a ground electrode into one eye and the recording electrode into a single basiconic hair of the antenna. Strong correlation was found between fluctuating carbon dioxide concentration and the ab1C neuron of the large basiconic sensilla on the posterior third segment of the *Drosophila* antenna.

The Influence of Cage Housing Environment on Breast Meat Quality Traits in Three Strains of Laying Hens (*Gallus gallus Domesticus*)

E. Lynch, K. Frizzell, Dr. B. Rathgeber, & Dr. M. Jendral

(Nova Scotia Agricultural College)

Layer housing environments that permit bone-loading activity and structural bone preservation may reduce hen bone fragility at processing and affect meat quality. The influence of cage environment and layer strain on breast meat quality was assessed for Lohmann Brown (LB), Lohmann Lite (LW) and Shaver White (SH) hens housed in Furnished Cages (FC) (240cm X 110cm) (40 hens/cage; n=4 cages/strain) and Conventional Cages (CC) (60cm X 55cm) (5 hens/cage; n=24 cages/strain) (18-80 weeks). Hens each had 660cm² floor space and in FC, could access a nestbox, perches and dustbath. Hens were electrically-stunned at 80 weeks and at 17 and 30 minutes post mortem (PM), pH and colour [lightness (L*); red (a*); yellow (b*)] analyses of right pectoralis major were conducted, respectively. Twenty-four hours PM, left pectoralis muscles were assessed for post-rigor pH and tenderness. Normalized data were analyzed using the PROC MIXED procedure of SAS. Significance was accepted at P≤0.05. Seventeen min PM pH values did not differ between treatments or strains. L* and b* values did not differ between treatments however in CC, SH meat was paler than LB and LW (P<0.05). Redness was higher for FC LW and LB than FC SH (P<0.05), and for CC SH than FC SH (P=0.03). CC a* values were also higher for LW than LB and SH (P<0.05), further suggesting that breast samples were darker for LW and LB than SH hens. Post-rigor pH and tenderness analyses will further reveal whether breast meat quality was influenced by housing environment and strain.

The Potential of Native Species in Preventing Germination of Unwanted Trees on an Extensive Green Roof

Lori Miller & Dr. Jeremy Lundholm
(Saint Mary's University)

Green roofs provide a number of valuable functions for the environment, but these benefits may be outweighed by construction and maintenance costs. Woody plants need to be removed from shallow soiled green roofs, but some types of green roof vegetation may be less susceptible to colonization thereby reducing maintenance costs. The aim of this study was to determine whether green roofs planted with species native to Nova Scotia would show variability in colonization by three unwanted tree species (*Picea glauca*, *Ulmus glabra*, and *Betula papyrifera*) on the Saint Mary's University Atrium green roof. To determine germination success, survival, and seed capture ability of the plant canopy, tree seeds were added either directly to the medium or atop the plant canopy, in replicated monocultures of 14 species. When seeds were added directly to the soil, no significant difference was detected between the monocultures for germination success or survival for *U. glabra* or *P. glauca*. However, when the seeds were added atop the plant canopy, percent germination of *U. glabra* was significantly higher in *Carex argyrantha* green roof modules. In general, sod forming graminoids showed higher germination of *U. glabra*. The number of seeds reaching the soil was typically lower in vegetation

with a denser canopy. *B. papyrifera* failed to germinate in all instances, likely due to the harsh conditions presented on the roof or poor seed quality. In general, some vegetation types are more repellent to colonization by tree species, but it depends on the tree species.

Look at you in those genes! Potential epigenetic effects mediated by environment in *Polydora cornuta*

Robyn Pierce & Dr. Glenys Gibson

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The environment can have a strong influence over a developing organism. Environmentally induced variation in phenotype during development is referred to as developmental plasticity and is thought to be based on epigenetic processes, such as histone modifications. The objectives of this study are to investigate whether epigenetic modifications are linked to developmental plasticity in the spionid species, *Polydora cornuta*, and to determine whether changes in histone modifications occur during metamorphosis. Adult *P. cornuta* were exposed to environmental treatments including those rich in methyl donors (e.g. Folate/vitamin B₁₂) and methyl releasers (e.g. Bisphenol A). Adult and larval tissues were treated with primary and secondary antibodies and then observed using fluorescent microscopy. In adults, similar patterns of H3K9 monomethylation were observed among treatments, however, hypomethylation of H3K4 and hypoacetylation of H3K14 were observed in tissues of enhanced and BPA females relative to controls. Selected tissues of control adults and larvae showed comparable H3K9 me1 patterns, however, adults from the BPA treatment showed H3K9 hypomethylation of the gut. The results of this study indicate that 1) the environment does effect histone modifications, which could ultimately produce alternative phenotypes, 2) two of three modifications varied with treatment in adult tissues, 3) and while tissues of *P. cornuta* appear to have similar H3K9 me1 patterns prior to and following metamorphosis, this modification in adults appeared sensitive to treatment (BPA). These results suggest that histone modifications are a potential mechanism by which the environment can influence developmental plasticity.

Analysis of a recently introduced mammal, Coyote (*Canis latrans*), to insular Newfoundland, using mtDNA and an MHC gene locus

Paul Pitts

(Memorial University of Newfoundland)

The coyote (*Canis latrans*) expanded its distribution in North America and were first recorded in insular Newfoundland in 1985. Few individuals colonized the island so the current population represents an ideal opportunity to investigate the genetics of introduction and the roles of selection and drift in shaping patterns of genetic variation in different genes with various functional modalities.

Mitochondrial DNA has been widely used in phylogeographic studies to understand ecological and evolutionary issues due to lack of recombination, maternal inheritance, high copy number, variable substitution rates across regions, and high mutation rate. Although mtDNA genes are subject to high functional constraints, evidence for positive Darwinian selection has been lacking; hence mtDNA is an important tool to study neutral genetic variation.

The MHC plays an essential role in the presentation of foreign peptides to the vertebrate immune system and is critical in regulating the immune response; it does this with high levels of polymorphism. The MHC is a well-studied genetic system that demonstrates evidence for the long-term

operation of balancing selection. MHC is a useful benchmark as the gene set rejects almost all the predictions of the neutral theory, so it is effective in detecting selection in a single generation, over the history of a population, and over the deeper evolutionary history of different species.

Purpose of this study is to contrast mtDNA variation with MHC variation in the recently founded NL coyote population to make inferences about the rates of evolution and strength of selection in these two systems.

Reaction of sand shrimp, *Crangon septemspinosa*, to sand patches covered by lime deposits

Ambre Ribardière & Dr. Stéphan Reeb
(Université de Moncton)

Epifaunal biofouling of cultivated mussels is commonly treated with large quantities of lime (calcium hydroxide, CaOH) which are then released in the sea. The present study investigated the reaction of sand shrimp, *Crangon septemspinosa*, to the lime products that are potentially deposited on the sea bottom which the shrimp inhabit. 6-L aquaria received either 0 mL (control), 10 mL, or 20 mL of a concentrated lime solution over one half of their sandy bottom. This created a carpet of flocculant material (magnesium carbonate and calcium carbonate) over the affected sand patch. Shrimp were individually released into these aquaria and their position (over clean sand or over flocculant) was noted twice a day for the next four days. Shrimp in the 20 mL group spent significantly less time over the flocculant (17% of observations over 4 d) than the 10 mL group (34%) or the controls (51%). This avoidance was stable over the 4-d period. Mortality was significantly higher in the 20 and 10 mL groups (51%) than in the controls (13%). Future studies should determine whether lime released at sea covers and persists over sea bottoms inhabited by sand shrimp, and whether other organisms could be affected.

Determination of diurnal rhythms in stem and leaf elongation rates in barley, oats, and corn, using rotary motion sensors

James Ross & Dr. David Kristie
(Acadia University)

Diurnal rhythms in stem elongation rates (SER) have been studied extensively in many dicots, particularly in the floriculture literature. In contrast, there have been few studies on the diurnal rhythms of SER and leaf elongation rate (LER) in monocots. In this project, the diurnal rhythms of SER and LER in barley (*Hordeum vulgare* L. cv. 'Chapais'), oats (*Avena sativa* L. cv. 'Triple Crown'), and corn (*Zea mays* L. cv. 'Miracle'), were examined under greenhouse conditions during the summer of 2010 and 2011. Plant growth was also measured in growth chambers under constant light conditions. Under greenhouse conditions, corn LER showed a peak during the mid-day. Oat LER, however, exhibited a broad peak in growth rate during the night. Barley showed a peak in LER during the day for leaves 2 through 4; however, the peak shifted to the night for leaves 5 through 7. The stem elongation rate for both barley and oats showed a peak in elongation during the night. A well-defined rhythm for SER in corn could not be obtained. Under constant light conditions, it was found that barley and oats LER exhibited a free running period of approximately 24 hours. A free running period of approximately 24

hours indicates that the rhythm in LER in barley and oats is endogenously generated and is under circadian control.

Abiotic and Biotic differences in Salt Pannes of Maritime Salt Marshes

Dylan W. Schneider & Dr. Myriam A. Barbeau
(University of New Brunswick, Fredericton)

The differing tidal regimes, weather patterns, and sediment loads in the Northumberland Strait, Bay of Fundy, and Nova Scotia's Atlantic coast affect the physical characteristics of salt pannes found along their shores, and in turn the panne biota. Water characteristics (temperature, salinity, pH, DO saturation, turbidity, and total suspended volatile and non-volatile solids) were measured in three replicate salt marshes per coastal area, as well as in four replicate sites in the coastal waters of each region. Type and density of panne species were measured in 10 replicate pannes from each marsh using four techniques (minnow trap, invertebrate activity trap, lift net, and sweep net). The abiotic and biotic variables will be compared within and between marshes and coastal regions. It is expected that variation between coastal regions will be greater than variation between marshes within coastal areas. Correlations between biotic and abiotic patterns will also be explored.

Dispersal and adaptation in a coastal beach plant

Kylie Tingley & Dr. Karen Samis
(University of Prince Edward Island)

Plants are sessile organisms that rely on external forces to disperse their genes. Several plant species have adapted mechanisms of long distance dispersal for maintenance of genetic diversity. Our ability to track dispersal through both gametes and seeds using genetic analyses makes plants ideal for studying adaptation in the face of high dispersal. *Cakile edentula* ssp. *edentula* is a common coastal plant species whose unique fruit morphology is adapted to long distance seed dispersal by ocean currents. Long distance dispersal should contribute to high gene flow between populations; hence, reducing the amount of genetic differentiation among populations. Because *C. edentula* is endemic to a highly dynamic coastal environment, some degree of local adaptation is expected for population persistence. Evidence of geographically structured genetic variation in this highly dispersive plant would indicate some dispersal limitation and possible adaptive phenotypic variation among populations. The objectives of my study are 1) to examine the level of genetic variation within and among Atlantic Canadian and Quebec populations of *C. edentula* using nuclear DNA markers; 2) examine variation in the chloroplast genome to track ancestral maternal lineages; and, 3) associate observed genetic variation with phenotypic variation measured on plants grown in a controlled greenhouse environment. With respect to genetic variation observed in 38 populations, I have identified two chloroplast DNA haplotypes and found low levels of heterozygosity in six microsatellite loci. These early observations point to the potential for detecting genetic differentiation among populations despite the expectation of high gene flow in this coastal plant.

Recruitment to the Benthos in the Sydney Harbour

David Woodland

(Cape Breton University)

Recruitment, the addition of new individuals to an existing population, occurs after larvae settle from the plankton onto the seabed and reach sexual maturity. Advection-dispersion, habitat selection, settlement and post-settlement growth are factors influencing mortality rates and, in turn, recruitment to an existing population. Thirty passive larval recruitment collectors deployed in the Sydney harbour (equally dispersed among 10 sample sites) at approximately 10m depth were used to assess spatial and temporal variations in the benthos over a total of 30 months (August 2009 – February 2012). To induce settlement and determine the optimal substratum for larvae settlement, the recruitment collectors contained rocks of three different sizes (1", 2" and 4"). Data were collected in the autumn of 2009 and 2010 as well as the winter of 2012 by retrieving the recruitment collectors and visually examining the rocks for macrofauna. All animals found were counted, measured and preserved. Data from the previous two years suggest that recruitment of lobster (*Homarus americanus*) and rock crab (*Cancer irroratus*) occur mainly in the summer and autumn months. Substratum size affected only lobster recruitment, crab showed no preference in substrate when settling. Both spatial and temporal variations in the recruitment of crab and lobster were observed; recruitment rates for crab were higher in the outer harbour whereas lobster recruitment rates were higher in the inner harbour. Both lobster and crab recruitment rates differed between years. Sampling of the 2012 data will incorporate other benthic species into future analyses.

Revealing the mechanism of rapid reovirus spread in cancer cells by exploring Ras signaling pathway

Hiromi Yoro

(Saint Mary's University)

Reovirus is known as an oncolytic virus, a cancer killer virus. Among oncolytic viruses, reovirus has potential for cancer treatment due to; a) its safety in human cancer patients, b) its selectiveness in the targeting of cancer cells and c) its effectively spreading/killing target cancer cells. However, few studies have been done to understand the mechanism of rapid reovirus replication and destruction in cancer cells.

Studies have showed that interferon production and response were compromised in Ras-transformed cells after reovirus infection. Interferon is produced as an immune response against viral infections. Presence of interferon, viral replication is suppressed in normal cells. On the other hand, in virus infected Ras-transformed cells, the production and response of interferon are inhibited, which allow reovirus rapid replication and cancer cell destruction.

The objectives of my study are; 1) to understand how activated Ras signalling leading to uncontrolled cell proliferation down-regulates interferon synthesis/signalling, and 2) to reveal the mechanism of rapid reovirus spread in cancer cells. In addition, we will be looking at the factors that could be involved in interferon β signalling and will make a comparison between non-transformed and Ras-transformed cells as well.