ASSESSING DNA DAMAGE AND REPLICATION INSTABILITY IN ENVIRONMENTALLY STRESSED SCHIZOSACCHAROMYCES POMBE CHECKPOINT MUTANTS

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Cell checkpoint pathways delay cell cycle progression in response to DNA replication stress or DNA damage. This tight control of the cell cycle ensures proper cellular proliferation and mutation prevention. In the fission yeast, *Schizosaccharomyces pombe*, Rad3, Mrc1, and Cds1 proteins control the replication checkpoint. Rad3, Crb2, and Chk1 proteins control the DNA damage checkpoint. In checkpoint protein deletion mutants, *S. pombe* cells lose the ability to arrest the cell cycle in the presence of replication stress or DNA damage, resulting in loss of viability. Work from the Sabatinos lab has shown that pre-exposure to environmental stress before the application of replication stress inducing drugs improves cell viability. In order to better understand the unknown mechanisms that promote survival, we have assessed whether levels of DNA damage and replication instability increase after the application of the drugs hydroxyurea and gemcitabine. These drugs are clinically used chemotherapeutic agents. Furthermore, we have observed whether DNA damage and replication instability decrease in pre-environmentally stressed drug-treated cells. Phospho histone γ-H2A is a symptom of DNA double strand breaks. To test for replication instability, we have identified the presence of DNA:RNA hybrids forming R-loops in gemcitabine, and see R-loop enrichment in the nucleolus of cells. Our results explore this situation of consecutive environmental and DNA replication stresses to understand how cells respond to chemotherapy in the tumour microenvironment.

Oral presentation A

ROLE OF TUBERIN AND CYCLIN B1 AS A DNA DAMAGE RESPONSE

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Tuberous Sclerosis (TS) is a multi-system disorder that causes the formation of benign tumours called hamartomas. In rare cases, this disease can progress to aggressive cancers. The cause of TS is a mutation in either the TSC1 or TSC2 gene that encode for the tumour suppressor proteins Hamartin or Tuberin protein, respectively. Our lab has characterized how Tuberin is able to regulate the G2/M transition of the cell cycle by binding and regulating the localization of Cyclin B1, the protein that allows for the transition of the cell into mitosis. The hypothesis is that misregulation of this process may facilitate the accumulation of damaged DNA allowing for progression to malignancy. This was assessed by constructing Cyclin B1 mutants and testing their binding to Tuberin using immunoprecipitation. The stability of Tuberin was also tested with graded amounts of Cyclin B1 and measured using western blotting. The accumulation of DNA damage was tested with wild-type or mutated forms of Tuberin with reduced binding to Cyclin B1. The data demonstrates that post-translational modifications of Cyclin B1 are critical for mediating the interaction with Tuberin and that abrogation of this binding results in reduced protein levels of Tuberin and enhanced accumulation of DNA damage. These findings support that the Tuberin-Cyclin B1 interaction is an important cellular checkpoint that protects cell integrity. Dissecting the mechanics of this checkpoint may reveal novel mechanisms for treating select benign and malignant tumours that impact the lives of many Canadians annually, with the majority of these being pediatric cases.

Oral Presentation
A: Cell, Molecular, & Genetics

ASSESSING THE EFFECT OF NITROGEN STARVATION ON GEMCITABINE SENSITIVITY IN FISSION YEAST

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Cell cycle checkpoints are imperative to preserve genome integrity and fidelity. Loss of checkpoint proteins deregulates the cell cycle, which contributes to cancer cells' replicative immortality and proliferative aging. Gemcitabine is a chemotherapy drug that inhibits DNA synthesis and causes cell death. Gemcitabine targets highly-proliferative cancer cells and is an important drug used to treat pancreatic cancer. We have previously shown that chemotherapy drug sensitivity can be altered by exposure to environmental stresses such as nitrogen starvation. We have also developed a new model system to screen gemcitabine sensitivity in fission yeast, *Schizosaccharomyces pombe*. Since gemcitabine affects human and *S. pombe* cells at similar concentrations, we now test the effect of nitrogen starvation on gemcitabine sensitivity. We compared cell survival in checkpoint mutants which should be sensitive to gemcitabine. In this project, we used flow cytometry and cell morphology to assess whether cells continue to divide in the presence of gemcitabine. Overall, we found that nitrogen starvation stalls cell cycle progression of most checkpoint mutants, except *cds1Δ*, which arrests in S-phase. Our goal is to understand how to improve gemcitabine's efficacy and treatment outcomes. The systematic assessment and quantification of nitrogen's effect on cellular sensitivity to gemcitabine may have clinical implications for tumours that are starved for nutrients.

Oral Presentation

Group A: Cell, Molecular, & Genetics

PROTEIN EXPRESSION PATTERNS IN HEMATOPOIETIC TISSUE OF PLK4 HAPLO-INSUFFICIENT MICE

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The polo-like kinase Plk4 is an evolutionarily conserved cellular protein that plays a key role in governing late mitotic progression and centriole duplication. This serine-threonine kinase has also been known to be involved in tumor suppressor pathways and aberrant expression tends to result in increased tumor formation. Previously, our lab has shown a higher incidence of splenomegaly in Plk4 heterozygous mice compared to that of wild type mice. It has also been shown in previous literature that expression of Plk4 is negatively correlated with Jak2 expression levels. The spleen plays a critical role in hematopoiesis in mice. As a result, there is a need to further investigate the effect of Plk4 haplo-insufficiency on the expression of interacting proteins that drive hematopoietic differentiation, specifically Jak2 as well as STAT5 which will in turn be used to check the activity of Jak2. The expression of these proteins will also be investigated in the bone marrow of Plk4 haplo-insufficient mice; the main site of hematopoiesis. Studies have suggested that hematological malignancies as a result of Plk4 haplo-insufficiency commonly affect myeloid lineages. Taking this into account, a study will be conducted of possible abnormalities in the expression level of MPO which is used as a marker for differentiated myeloid cells. The investigation of these novel protein interactions ultimately allows for a better understanding of the effect of Plk4 in relation to myeloid type cancers.

Oral Presentation

A: Cellular, Molecular & Genetics

Sulfonamides in the prevention of amyloid beta (Aß) aggregation in Alzheimer's disease

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Considering the prevalence of Alzheimer's disease (AD) and lack of effective therapies, repurposing existing drugs can prove to be a more pragmatic and cost effective approach than designing, testing and approving new therapeutic agents. In this regard, the sulfonamide class of drugs has already been used with success to treat a broad range of diseases and has the potential to treat AD. One of the key factors involved in the pathogenesis of AD is the amyloid beta (Aß) cascade, which leads to the accumulation of neurotoxic Aß aggregates. This project investigated the ability of sulfonamides to inhibit Aß aggregation. Anti-Aß activity of eight existing sulfonamide-based drugs (acetazolamide, celecoxib, zonisamide, almotriptan, tamsulosin, famotidine, tolbutamide, and zafirlukast) was tested using thioflavin-T (ThT)-based fluorescence spectroscopy. Of the sulfonamides, acetazolamide, celecoxib and zafirlukast, were found to exhibit inhibition of aggregation in this first step. Subsequently, the interaction of the Aß dimers with the identified promising compounds was computationally modeled to better understand the dynamics of Aß aggregation and potential mechanism for inhibition. The resulting aggregate morphology was additionally examined through transmission electron microscopy (TEM). These investigations provide evidence on the application of acetazolamide, celecoxib and zafirlukast as potential AD therapeutics.

Oral presentation
Cell, Molecular & Genetics

DEVELOPING HUMAN ORGANIC ANION-TRANSPORTING POLYPEPTIDE (OATP1) AS A PHOTOACOUSTIC REPORTER SYSTEM USING THE CLINICALLY-USED DYE INDOCYANINE GREEN

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Molecular-genetic imaging uses reporter genes for *in vivo* monitoring of cells and gene vectors in both preclinical models and the clinic. Clinical uses have included monitoring novel gene-based or cell-based therapies. Photoacoustic imaging (PAI) is a relatively new imaging modality that combines the spatial resolution and depth perception of ultrasound imaging with the high image contrast of fluorescence imaging. Compared to other clinical imaging methods such as MRI or PET, PAI is relatively cheaper and expected to be more accessible. However, reporter genes for PAI have been sparsely described and none have been approved for clinical use. Here we explore the use of the human organic ion transporter polypeptides 1B1 (OATP1B1) and 1B3 (OATP1B3) as new PAI reporters using the clinically-used dye indocyanine green (ICG). OATP1B3-engineered cancer cells incubated for 4 hours with ICG in concentrations ranging from 0.4 to 50mg/mL showed significantly higher fluorescent signal compared to control cells. In preliminary tests, OATP1B3-engineered cells also retained ICG longer than control cells. OATP1B1 did not show significant uptake of ICG. Our work to date shows that OATP1B3-engineered cells readily take up ICG. Future work includes performing PAI on engineered and control cells with and without ICG incubation, and PAI studies in mice bearing OATP1B3-engineered tumors or control tumors. This work will provide proof-of-principle that human OATP1B3 can be used as a novel PAI reporter, allowing broad exploration of it as a new tool for *in vivo* monitoring of gene and cell therapies in preclinical models, and hopefully patients.

Oral presentation
Group: Cell, Molecular, & Genetics

CREATION OF AN OPTOGENETIC SPLIT PROTEASE

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The ability of cells to communicate to each other is vital for cell function and cell survival. One key way in which cells communicate with one other is by modulating the levels and activity of transcription factors in the cell, which, in turn, results in the modulation of target gene expression. However, the dynamic nature of cellular signaling, in addition to the inherent stochasticity of cellular signaling pathways has imposed significant limitations on our ability to study transcription factor function in real time. To circumvent these limitations, I have designed and implemented an Optogenetic split protease system that provides exquisite light-gated control of both the spatial and temporal activation of transcription factor function. This system has been engineered to allow for both the visualization of functional reconstitution of a bipartite split protease, as well as the transport of functional, fluorescently tagged transcription factors from the plasma membrane to the nucleus. This system is non-functional in the absence of light, and when only individual component protease halves are present, and exhibits rapid (millisecond) activation of transcription factor liberation from the plasma membrane in response to blue light (~ 488nm) exposure. I am currently applying this system to study how cellular signals regulated by the Notch signaling pathway relay their effects on gene expression in real time, and in the context of human cancer stem cell proliferation.

Oral presentation and or poster presentation

A:cell,molecular&genetics

COMPREHENSIVE ASSESSMENT OF THE IMPACT OF VARIOUS FLUORESCENT PROTEINS ON THE FUNCTIONS OF FUSION PARTNERS

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Fluorescent protein tags are important tools for detecting the expression and localization of various proteins. *Saccaromyces cerevisiae* can be used as a model to help elucidate the effects of different fluorescent fusion proteins. Although a wide palette of fluorescent proteins has been identified, some of these proteins that have been previously described as monomeric have not always behaved as monomers; they formed oligomers as fusion-partners. Monomeric fluorescent proteins have better stability, decreased oligomerization and decreased protein-protein interactions, which will ensure that few artifacts will be produced when studying fusion proteins. Here, I will investigate the impact of the latest generation of red fluorescent proteins (mScarlet, mFusion Red, mCherry) and green fluorescent proteins (msfGFP) on protein expression and localization. I aim to examine the toxicity of the aforementioned fluorescent proteins by employing the Huntington yeast model and measuring the levels of protein aggregates. I hypothesize that two main findings will prevail; first, the mScarlet fusion proteins will cause allow for the expression of the mutant Huntingtin protein, confirming the effectiveness of mScarlet fusions. Second, moxGFP fusions will allow for brighter imaging of the mutant Huntington protein, and allow for regular protein trafficking.

Oral Presentation

Group A: Cell, Molecular, & Genetics

A FRAMEWORK FOR INCORPORATING SPATIAL BYCATCH ASSESSMENT INTO FISHERIES MANAGEMENT

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By-catch is a major issue for the development of sustainable fisheries and the conservation of non-target species. Many deep water, artic species are particularly susceptible to exploitation as by-catch because of their k-selected, life-history traits (for example, longevity, slow growth and low fecundity). Here, we propose a conceptual model to describe how the interconnectivity of movements of a by-catch species within an ecosystem, in this case across a proposed Inuit community fishing ground, can reveal details relevant to understanding a species vulnerability to capture and indirect exploitation in fisheries. The model proposes three key scenarios; (i) the population of the by-catch species uses the habitat equally (ii) the population exploits a central area within the habitat and (iii) the population exploits two or more areas with high interconnectivity. A comprehensive grid of acoustic receivers in Scott Inlet, Nunavut was used in conjunction with multi-year tracking data of a common Arctic by-catch species, Arctic Skate (*Amblyraja hyperborea; n=21*), to validate the application of the model. A spatial, bipartite graph of the *A. hyperborea* network within the fishing ground, based on individual detection data, was constructed. The network, formulated by connecting vertices by the number of movements along an edge, was then overlaid onto a 95% Brownian Bridge kernel density plot depicting *A. hyperborea* high use areas. Results provide a dynamic view of *A. hyperborea* movements across the entire habitat but demonstrate high centrality in the South-Eastern region of the fishing ground equating to model scenario (ii). The main findings of the study highlight the scope of a telemetry approach to quantitatively address species-fishery interactions using spatial movements. These considerations, together with the increasing availability of biotelemetry data, provide a framework to formally introduce spatial by-catch assessments into fisheries management.

Oral presentation—B

ASSESSING THE MEDICAL PROFESSION'S ADOPTION OF AN ADAPTIVE FRAMEWORK IN STUDIES OF MATERNAL STRESS.

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While short-term activation of Hypothalamic Pituitary Adrenal (i.e., Stress - HPA) axis via the release of glucocorticoid hormones is adaptive, long-term exposure of maternally derived stress hormones has commonly been assumed to cause costs to mothers and offspring. However, the Developmental Origins of Health and Disease (DOHD) and the Predictive Adaptive Response (PAR) hypotheses proposed evolutionary frameworks to examine the offspring responses to maternal stress within an adaptive paradigm. Adaptive insight into the long-term effects of maternal stress has been suggested as a productive means to aid epidemiologists and medical professionals in explaining how early-life stressors induce disease later in life, which environments increases the risk, and therefore how best to design potential mitigations or treatments to benefit disease outcomes. Despite fairly significant attention to the evolutionary aspects of maternally-induced effects on offspring phenotype and fitness, it has been unclear whether the field of medical research has put any of these adaptive frameworks into practice. By combining the tracking of published peer-reviewed papers over time (which have adopted the adaptive framework) with an assessment of how often the papers in the adaptive literature have been published, we aim to determine: 1) whether the medical field has adopted an evolutionary approach to studying maternal stress, and if so, 2) whether certain sub-disciplines have lead the way in this adoption. Overall, this review aims to increase exposure of medical studies to adaptive frameworks of maternal stress effects to ultimately improve the diagnosis and treatment of stress-induced developmental diseases.

Oral Presentation
B: Ecology & Evolution

Misconceptions About Evolution: A Framework for Understanding How Misconceptions Surrounding Evolution Act as a Barrier to Student Learning

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Persistent misconceptions about biological concepts can hinder student learning. This is particularly true for evolutionary concepts. A student's ability to comprehend evolution is critical in their understanding of the biological world. Furthermore, their ability to grasp evolutionary concepts correctly will impact their understanding of the natural world and capacity to advance science and technology. This project presents a meta-analysis of misconceptions about evolution found in the scholarly literature, and presents a cognitive framework that can assist in organising and understanding these misconceptions, especially with respect to how they hinder further knowledge and understanding. The meta-analysis identified different categories of misconceptions, including acquired beliefs, cognitive pre-disposition, conceptual misunderstandings, and language barriers. The meta-analysis also explored the solutions to overcome misconceptions in the classroom while teaching evolutionary concepts. This presentation will profile common misconceptions held by students and approaches to overcoming these misconceptions through teaching.

Oral Presentation

Group B: Ecology and Evolution

The Effects of Cooking on EPA and DHA in Great Lakes' Fish

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Restriction advisories on the consumption of fish have been implemented by the Ontario Ministry of Environment and Climate Change (OMECC) to limit the risks associated with elevated contaminant levels in the Great Lakes. Consequentially, these restrictions may also limit the amount of beneficial omega-3 fatty acids such as eicosapentaenoic acid (EPA; 20:5n-3) and docosahexaenoic acid (DHA; 22:6n-3) that can be obtained from routinely consuming fish. The amount of EPA and DHA intake can be estimated through fatty acid analysis, however, raw fish samples are typically used. As a result, such analysis may provide an inaccurate representation of the actual amount of EPA and DHA intake because the process of cooking is omitted. This is attributed to the modifications of nutritional qualities in food that can be prompt through various culinary methods. In this study, we barbequed five different species of fish from the Great Lakes— Northern Pike (*Esox lucius*), Walleye (*Sander vitreus*), Yellow Perch (*Perca flavescens*), Brown Bullhead (*Ameiurus nebulosus*), and Largemouth Bass (*Micropterus salmoides*). Fatty Acid analysis, via Folch method, was conducted to compare the amount of EPA and DHA content between raw fillets and two treatments (skin-off and skin-on) of cooked fillets. Generally, there was no statistical differences found between cooking the fillets skin-off or skin-on ($p>0.05$). However, Walleye fillets cooked with the skin on had marginally higher EPA+DHA concentrations ($p= 0.06$). This suggests that the effects of culinary procedure on EPA and DHA within fish may be species dependent.

This abstract is for the **Oral Presentation**, judged under **Ecology and Evolution** group

THE EFFECT OF A DELAYED SPRING ON LATE GROWING SEASON ROOT SENESCENCE AND NUTRIENT UPTAKE IN *RHYNCHOSPORA ALBA* (L.) VAHL (CYPERACEAE).

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For herbaceous plants, adaptation to seasonal climates with long winters is associated with senescence in the fall. *Rhynchospora alba* (Cyperaceae) overwinters as bulbils produced towards the end of the growing season. The objective of this study was to understand how the time of the start of the growing season affects the timing of senescence and nutrient uptake of *R. alba* in the fall. I planted 75 bulbils of *R. alba* in early May within a cold frame to simulate a warm May, and another 75 bulbils three weeks later to simulate a cold May. ^{15}N tracer was added to the substrate of 6 plants from each of the treatments every two weeks, starting mid August. In late October, all plants were harvested and analyzed for their total nitrogen and ^{15}N content. The plants from the warm May treatment began above- and below-ground senescence earlier than the plants of the cold May treatment, and took up less ^{15}N later in the fall. Plants of the Cold May treatment caught up to achieve complete senescence prior to the onset of winter. These plants took advantage of their longer-lived roots and the overwintering bulbils were able to accumulate the same amount of nitrogen for the following growing season. In contrast to above ground phenology, less is known on the effects of warming global temperature on root phenology, nutrient uptake, and nutrient economy. Our data will enhance understanding of these processes and help to predict effects of climate change on plant phenology.

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Oral Presentation

B: Ecology and Evolution

BIODIVERSITY AND NUTRIENT UPTAKE OF VEGETATION IN THE RIPARIAN AREA OF THREE STORMWATER RETENTION PONDS IN THE GREATER TORONTO AREA

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Stormwater ponds have been implemented in many municipalities as a method to mitigate potential for flooding and to remove pollutants from runoff in urbanized areas. Vegetation surrounding these ponds assist with retention and absorption of run-off from urbanized areas while also preventing erosion of the soil. Macrophytes found in these areas play a key role in the environmental quality of aquatic systems by stabilizing surface beds, providing good conditions for filtration while assisting with the uptake of nutrients with their metabolism. Not many studies have been done to study the biodiversity of vegetation surrounding stormwater ponds. The study at hand analyzes the biodiversity and nutrient uptake of vegetation in the riparian area of stormwater ponds in the Greater Toronto Area. Hydro East Pond (HEP), Mattamy Rouge (MAT) and Earl Bales (EB) were used for this study. A qualitative approach was used to collect specimen samples of vegetation and to assess the biodiversity of the area. The ponds were subdivided into transects and each area was analyzed for dominance, co-dominance, invasive or rare species. Specimens were categorized into three categories from most dominant to rare in the area where found. There was a major dominance of macrophyte species of *Phragmites australis* and *Typha latifolia,* which was expected in this area. These major species were analyzed chemically to find the chemical breakdown of their nutrient uptake and compared against the expected Redfield ratio. This study provides a backbone for future research of plant species surrounding stormwater ponds in the Greater Toronto Region.

ORAL PRESENTATION- B: ECOLOGY & EVOLUTION

SOIL PROPERTIES OF A TECHNOSOL COMPOSED OF BIOSOLIDS AND MUNICIPLE COMPOSTS USED IN THE RECLAMATION OF LOW-SULFUR, NICKEL-COPPER CONTAMINATED MINE TAILINGS

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Mining activities have been responsible for extensive damages of soil, vegetation and for altering the microbial communities. Reclamation of damaged land is becoming increasingly important as we understand the negative impact that abandoned mines have on the environment. The Sudbury basin has been mined for its magmatic Ni-Cu-platinum-group element sulfide deposits which has caused acid rock drainage, decreasing the pH of soils in the region. In 2008 Strathcona Mill began closing operations and created a tailings site composed of low-sulfur tailings. Prior to this study the tailings were treated in 2015 with municipal biosolids treated with lime (N-Viro™), and municipal compost (Grobark™) in nine application rates with the aim of establishing a viable growth medium. The initial growing season yielded little to no growth of the planted oats (*Avena sativa)* on any of the plots. During the next growing season, a cover of 90-100% of native grasses was observed on all plots. In the present study, 54 soil cores were extracted using a core sampler and the cores were then frozen until processing. Soil pH and EC in the core were measured at three depths to test for stratification of H+ and cations. Moisture content and loss on ignition tests were run to give an idea of the organic carbon content. The goal is to identify the application rates for N-Viro™ and Grobark™ to provide and optimal growth medium without overapplying biosolids to the point where leaching nutrient into the environment becomes a negative impact.

Oral Presentation

B: Ecology & Evolution

THE EFFECTS OF SRC ON PLANT GROWTH AND SILICA CONTENT IN COVER CROPS AND GRAPES

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Recent issues surrounding agriculture sustainability and climate change have discouraged the use of synthetic fertilizers due to their negative effects on the environment. Although synthetic fertilizers are commonly known to improve plant growth, recent interest has shifted towards alternative soil amendments due to their more benign environmental impacts. In this study, the effects of Spanish River Carbonatite (SRC) agrominerals on plant growth and silica levels in cover crops and grapes were studied in comparison to a nitrogen, phosphorus, and potassium synthetic fertilizer (NPK). The experiment was carried out in three settings: 1) a controlled greenhouse, 2) semi-controlled garden, and 3) operational vineyard, each with three treatments: 1) SRC, 2) NPK, and 3) no amendment. Plant combinations included intercropped and individual alfalfa, radish, chicory and red clover, as well as monocropped and individual ryegrass. Root and shoot fresh weight, dry weight, and moisture content were measured for all samples. Furthermore, silica levels were measured for greenhouse intercrops and grape leaves, and percent herbivory was estimated for all plants in the gardens. Greenhouse results showed that alfalfa and red clover grew largest with SRC amendments, while chicory, radish, and rye grew largest with NPK. Some trends also demonstrated that the presence of SRC and NPK soil amendments increased silica levels in alfalfa, red clover, chicory, and radish. In the gardens and the vineyard, very few significant differences were observed. Overall, the addition of NPK and SRC both had benefits for plant growth, and the use of both in combination should be investigated.

Oral Presentation
Group B: Ecology & Evolution

THE EFFECT OF ELEVATED INCUBATION TEMPERATURES ON ATRIAL NATRIURETIC PEPTIDE MRNA LEVELS AND EARLY HEART DEVELOPMENT IN ATLANTIC SALMON, *SALMO SALAR*

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Abstract: As ectotherms, Atlantic salmon development is greatly influenced by environmental temperatures, as increases in water temperature are associated with higher metabolic rates in response to increased oxygen demands. Egg incubation is a critical time for optimal growth and development of fish. Previous studies in our lab have shown that increasing incubation temperatures leads to increases in maximum heart rate. Additional studies in the Neff lab found that larger salmon hearts are correlated with higher thermal performance. One factor affecting the growth and development of the fish heart is the expression of the cardiac hormone, Atrial Natriuretic Peptide (ANP), which acts as a negative regulator of cardiac growth during development, along with osmoregulation functions in adult fish. Previous research has suggested expression of *ANP* is influenced by environmental temperatures. Using Real-time quantitative PCR analysis, our research examined mRNA levels of *ANP* and its receptor, Natriuretic Peptide Receptor-Atrial (*NPRA*), in Atlantic salmon (*Salmo salar*) raised in current or projected future temperature conditions, at both the embryonic and parr stage. We also examined the effect of temperature-dependent *ANP* mRNA levels on early heart morphology in juveniles. A higher incubation temperature was hypothesized to be associated with lower *ANP* mRNA levels, and larger ventricle size in juvenile salmon. Supporting our hypothesis, we found higher *ANP* mRNA levels at elevated incubation temperature treatments at the time of chamber ballooning and full heart functionality. However, *ANP* and *NPRA* mRNA levels and relative ventricular mass of juvenile salmon hearts did not differ between temperature treatments. Understanding the influence of environmental temperature on cardiac development in salmon will help us understand how rising environmental temperatures, due to climate change, may impact wild Atlantic salmon populations.

Oral Presentation: B: Ecology and Evolution

Comparison of the Development Times of Selected Species of Dytiscidae (Coleoptera: Adephaga) at constant temperature

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As predators, the diving beetle family Dytiscidae (Coleoptera: Adephaga) plays an important role in freshwater ecosystems. They are highly variable in size, representing some of the smallest and largest of all water beetles. With this variability, one could wonder if the growth rate of the eggs and larvae may be influenced by their size. We hypothesize that egg development will increase with increasing size of dytiscid, as well as similar rates of development between closely related phylogenetic groups (i.e. of similar size). To test this, I compared egg to instar I development times of species and subfamilies of various sizes. Data was pooled from 7 years of laboratory tests performed by Dr. Yves Alarie on multiple species and groups across North America. Contrary to the original hypothesis, egg development times do not depend on egg size but seem to be dependent on the type of environment, the degree of potential threat from predators as well as when in the year the eggs were laid. More tests need to be done to determine which factors have the greatest influence on their development; however this study provides important information on which factors could have the greatest influence on dytiscids as global temperatures rise, seasons shorten and new threats (i.e. predators) are introduced to their environment.

Oral Presentation
B: Ecology & Evolution

"ECOGEOGRAPHICAL AND CLIMATIC PREDICTORS OF GEOGRAPHICAL VARIATION IN PLUMAGE AND MORPHOLOGY IN RUFOUS-CAPPED WARBLERS, BASILEUTERUS RUFIFRONS

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Many broadly distributed species exhibit geographic variation across their range. Intraspecific geographic variation can allow us to test ecological and sexual selection hypotheses that may explain this variation. In this study, we quantified geographical variation in morphology and plumage colouration of rufous-capped warblers (Basileuterus rufifrons), a broadly distributed Neotropical passerine bird. We measured morphological characteristics and plumage colouration of 473 museum specimens covering the entire species' range, and compared these with geographic location and climate data obtained from WorldClim and the United States Geological Survey. If variation in body size follows Bergman's rule, we expect body size to increase at higher latitude and in colder temperatures, whereas if body size follows Allen's rule, we expect extremities to shorten at higher latitudes and in colder temperatures. If plumage colouration follows Gloger's rule, we expect colour to become darker in humid climates, whereas if it is limited by the availability of nutrients, we expect brighter plumage colour in habitats with greater primary productivity. If sexual selection drives divergence in male and female body size and colouration, we expect birds in northern populations to exhibit greater sexual differences and more contrasting plumage against the vegetation background than southern populations, where male and female sex roles are expected to converge. Data analyses are still in progress. Our research will help us better understand the relative importance of ecogeographical rules and the influence of sexual selection on geographic variation, and may help us predict how animals could respond to future changes in environmental conditions.

Abstract is for an Oral Presentation
To be judged in B: Ecology & Evolution

CORRELATIONS OF SUBCUTANEOUS FAT AND REPRODUCTIVE PARAMETERS IN THE ARCTIC FOX (*ALOPEX LAGOPUS*)

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Arctic fox (*Alopex Lagopus*) has one of the most important roles of arctic animals in providing the equipment and supplies necessary to maintain an association with the land of peoples living in the Arctic. Understating its basic biology and ecology is very important, especially its reproductive parameters to better be able to continue a sustainable trapping. The arctic fox is important for a source of fur, which is used for clothing and revenue in the northern communities where an employee is high. The objective of this research is to describe the correlations of subcutaneous fat in the Arctic Fox (*Alopex Lagopus*) with the variability associated with reproductive parameters. A data-set of forty-two female Arctic fox (*Alopex lagopus*) carcasses was used. The carcasses were purchased from Inuit trappers at Eskimo Point, Northwest Territories, Canada in 1983-1987. Subcutaneous fat reserves on each animal were scored on a scale ranging from 0 to 4. The number of placental scars were recorded and ranged between 1 to 19. Placental scars in mammals represent the number of pups found in a litter. Data was being analyzed seasonally (monthly) and over the four-year duration of the study. It is expected that higher subcutaneous fat indexes will be correlated with higher numbers of placental scars seasonally and multi-annually. It is hypothesized that subcutaneous fat is the primary energy source for successful reproduction and litter size.

Key-words
subcutaneous fat, reproduction, ovulation, litter size, female infertility, Arctic fox

Oral presentation
B: Ecology & Evolution

DARK DATA IN HEALTH: CAN BIOMETRIC DATA PREDICT LIFESTYLE IMPACT ON COGNITIVE PERFORMANCE?

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The purpose of this study is to see if life style choices could impact cognitive and physical performance, 36 hours later and whether such impact could be predicted from biometric data. Data collection periods consist of recording sleep 1, the day post-sleep 1, and sleep 2 through the use of Hexoskin shirts. These shirts provide ECG, respiration thoracic and abdominal, and acceleration on three planes. Along with the use of blood pressure monitors (seven times a day), heart rate variability (four times a day) and a hand dynamometer (four times a day), help assess the physiological and the physical variables during different trials. Trials during recording periods consisted of a combination of two categories: (1) workout or no-workout (afternoon of data collection) and (2) breakfast/no breakfast/sugar-based breakfast on the morning of the day of data collection. These protocols are representative of different life-style choices that may result in noticeable differences in performance. Cognitive performance was measured through an online interface called BrainCheck. BrainCheck measures cognitive processing, executive function, task switching, and memory. These assessments are measured through performance on tests: Tail Making Test B for task-switching; Immediate and Delayed Recall Test for memory; Stroop Test for executive function; and Digital Symbol Substitution for cognitive processing.

Oral Presentation. C. Physiology and Toxicology

A PORTABLE, INEXPENSIVE HEARTRATE MONITORING SYSTEM TO AID WITH PATIENT COMPLIANCE FOR REHABILITATIVE EXERCISE POST-CONCUSSION

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Concussion recovery can be difficult to quantify as practitioners typically rely on self-reports of symptoms, while autonomic markers, such as heartrate variability, may provide a more quantitative measure of concussion severity. The current recommended practice for concussion rehabilitation involves mild exercise which gradually increases in intensity as recovery progresses; however, people with concussions have especially high rates of noncompliance with prescribed exercise routines at the expense of efficient recovery. The objective of this study was to create a portable, inexpensive device which gives practitioners exact data on degree of heartrate variability and rehab compliance by monitoring heartrate and exercise duration while giving the patient real-time feedback to keep their heartrate within an elevated yet safe zone. A custom MatLab program recorded the output from an Arduino microcontroller unit connected to a finger pulse monitor and a heart rate monitor with electrodes placed over the sternum and under the left arm, while heart rate output was displayed in real-time on a screen in relation to the target heartrate window during exercise. Preliminary results show a clear heartbeat waveform can be obtained for practitioner prognostics using 5 second rest periods during exercise, and the real-time heartrate display encourages subjects to reach and maintain the goal heartrate for the desired exercise duration. This portable, inexpensive system for recording heartrate and heart waveform encourages patient compliance for more efficient concussion recovery while providing clinicians with quantitative measures of compliance and autonomic recovery post-concussion.

Oral Presentation
C: Physiology and Toxicology

DEVELOPMENT OF A NOVEL CONCUSSION MONITORING DEVICE AND COLLECTION OF BASELINE DATA FOR HEAD MOVEMENTS DURING ROUTINE ACTIVITIES

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A significant amount of research in the last decade has been devoted to the prevalence and severity of concussions, particularly with regard to quantifying concussive impact force, and real-time monitoring of head movement. The interpretation of data generated by commercially available concussion monitoring devices, used to detect head impacts during sporting events, is limited by the absence of baseline data for signal comparison. Therefore, it is important to consider normal head motions (acceleration, rotation, angular velocity) experienced during sporting events or activities so that these devices can be specifically customized to the individual. The objective of this study is to develop a novel concussion monitoring device and collect baseline data for head movements during routine activities. Additionally, drop tests will be conducted using an artificial head to determine the average force of impact required to elicit a concussion. The prototype to be tested in this study consists of two sensors (each having a triaxial accelerometer and triaxial gyroscope), lithium battery, single-board microcontroller, and an SD card to store the data. We expect to observe differences in all three measurements (acceleration, rotation, angular velocity) among various activities and impact forces that are comparable to literature values. The collection of baseline data could potentially help identify a concussive event in the future by allowing an athlete to distinguish between normal and abnormal head movements.

Oral Presentation
Physiology & Toxicology

FABRICATION AND CHARACTERIZATION OF A PDMS BASED CAPACITIVE, FLEXIBLE PRESSURE SENSOR FOR BIOMEDICAL APPLICATIONS

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Abstract

This work presents the fabrication and characterization of a flexible capacitance based pressure sensor for biological applications. We contrast and compare the effects of micro structuring size of PDMS (Polydimethylsiloxane) and its effect for detecting small differences in pressure; a valuable trait in terms of bio-sensing. The current methods of constructing the micro structures of the PDMS dielectric contained within devices are expensive and not large area compatible. The micro structuring of our device was done as described by *Grzybowki et al*. where PDMS was casted upon a commercially available safety tape, which contains microstructures that can be incorporated into the PDMS after curing upon the tape [2,3]. Polydimethylsiloxane (PDMS) was used as a dielectric for the flexible device due to its elastic properties being tunable based on the ratio of pre polymer to cross linker. The elasticity is important in defining the range of pressure sensing detection possible and was determined through Intron Tensile Testing where Young's Modulus values ranged from 2 – 15 MPa for 20:1 PDMS. The structures were characterized to be on the scale of 90 microns; which is comparable to the size of the structures of the photolithographic method sample used with an approximate scale of 60 microns. We hope to construct and characterize a large area compatible capacitive, flexible pressure sensing device with similar sensitivities of previously defined works based on photolithographic and 3D printed mold methods of microstructure construction with sensitivities of 0.55 kPa^{-1} and 1.62 kPa^{-1}, respectively [2,3]. Due to the anticipated sensitivity of this device, it has a wide range of applications in the field of biology and medicine. These applications include yet are not limited to cardiac health monitoring [4], rehabilitation feedback [5], tension monitoring, and surgical implant devices [6].

Oral Presentation

Group C

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Scientific Jargon as a Barrier to Learning Biology

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The scholarly literature reveals several barriers to learning biology. These include subject-specific barriers such as persistent misconceptions, and also generalized barriers such as time management. Scientific jargon is an additional potential barrier to learning, however it has not had a lot of attention in the scientific press and scientific literature, though more interest has recently been generated in this field. The purpose of this study was to identify problematic scientific jargon that may act as a barrier to learning biology, and also to gather data on student perspectives of the role jargon plays as a learning barrier. The jargon was identified by considering common biological terms with multiple meanings, that can pose as potentially confusing terms for students reading scientific literature. Examples of terms that were identified as potential learning barriers included fitness, adaptation, evolution, organic, natural, significant, and theory. In order to gain more insight into students' academic/social background, their understandings of the examples of jargon chosen, as well as their viewpoints on the presence of scientific jargon in literature overall, 30-minute student interviews were conducted. The results obtained from a diverse group of students show a vast array of responses and reactions to the jargon presented in the interviews. Overall, the responses to jargon gathered through the interviews gave more insight into the variability in understanding common scientific jargon terms. In this session, we will identify trends, commonalities, and differences present among the student responses that can give further comprehension into how scientific jargon as a learning barrier can be appropriately addressed and overcome.

Abstract for Oral Presentation

Group I would like to be judged: Science Education

BIOCAREERS: LEARNING FROM OUR ALUMNI

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Biology undergraduates often have a limited perspective on career opportunities that a biology degree can help them access. This limited perspective regarding career paths may also constrain course choices and breadth of interest in the field of biology to those areas they associate with their career focus (e.g. medicine). Although resources are provided by institutions (e.g. career centres), students may not use these resources to explore their options fully or sufficiently early in their degrees. Furthermore, biology faculty with their highly focused career path, may not be able to provide their students with a breadth of up-to-date career insights. Arguably, the group best placed to provide current career path information to our undergraduates are our alumni. As former members our students' peer-group their advice may also be perceived as the most engaging and relevant. In this project we aim to engage undergraduates early in their career-planning and provide practical information on various careers in Biology with advice obtained directly from bio-alumni in video interviews. A suite of questions was prepared in consultation with current undergraduates, biology faculty and Careers Centre at UTM. Bio-alumni representing diverse employment sectors were then interviewed on video and their responses transcribed. The footage is now being edited to provide short informational videos and Q&A texts offered online to our undergraduates, which can be searched by them on a 'by employment sector' or 'by interview question', or for more general career advice. Current milestones, and future directions will be explored during this presentation.

Oral Presentation
D (Science Education)

Title: Testing the Effectiveness of a Video Learning Module in Helping Science Students Understand the Process of ATP Hydrolysis

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Science students often learn and reinforce concepts in a variety of ways. These methods can include but are not limited to attending lectures, seeking extra help through tutors, their peers or professor office hours, or through self-study. As science students begin to take on more and more activities outside of their core courses, self-study is becoming growing tool for students looking to reinforce various topics. However, some topics have proven more difficult than others for students to grasp. For this reason, a video learning module was created for introductory science students at Ryerson University. A short test will be administered to the students before watching the video in order to gain perspective as to their current level of understanding of the topic. After allowing the students to view the video, a post-video assessment will be administrated to students. The correlation between the video learning module and test results will be analyzed as well as a simple regression analysis will be performed between performances on the video learning module quiz and their previous year biology grades. The results of the two tests will be compared and analyzed in order to check for any significant changes in overall results. It will also be used to make recommendations for providing self-study video material as an added learning option for science students.

Oral Presentation

Judged Based on: Category D – Science Education