CIBC Health & Science Summer Research Assistantships in Cancer Biology

Below is a list of possible sponsors for the CIBC Health and Science Summer Research Assistantship in Cancer Biology. You may apply to more than one sponsor.

Department of Human Health and Nutritional Sciences
More information regarding each sponsor’s research and contact information can be found on the Department of Human Health and Nutritional Sciences website.

Jeremy Simpson, HHNS
Fatigue is a common complaint among cancer patients, reducing daily activity and quality of life. Cancer-related fatigue is commonly associated with anemia, present in ~75% of cancer patients. Recombinant erythropoietin (EPO) therapy is the most successful biopharmaceutical to correct anemia. While EPO seems like a feasible treatment option for cancer-related anemia, several clinical trials using EPO in patients have been terminated due to increased mortality. The problem is that EPO also protects cancer cells making them resistant to chemotherapy. Our overall aim is to investigate a novel mechanism to treat anemia. Our lab is working on a new biopharmaceutical that is able to correct anemia while not protecting cancer cells. A summer student will be responsible for working with our team to help validate our new biopharmaceutical therapy.

Department of Integrative Biology
More information regarding each sponsor’s research and contact information can be found on the Department of Integrative Biology website.

Dr. Jim Ballantyne
My research focuses on the role of hydroxyurea in disease resistance in animals. We have discovered that hydroxyurea occurs at high levels in elasmobranchs (sharks and their relatives) and moderate levels in some invertebrates and other vertebrates. Hydroxyurea is a known antiviral, antibiotic, antifungal and antineoplastic compound used clinically to treat a range of human diseases. It was not previously known to occur in animals. Our work is to map out the occurrence of this compound in diverse animal groups (biodiversity) and establish its role and regulation as a natural anticancer compound (cancer research).

Department of Molecular and Cellular Biology
More information regarding each sponsor’s research and contact information can be found on the Department of Molecular and Cellular Biology website.
**Dr. Andrew Bendall**

Vertebrate Dlx genes are expressed in a variety of embryonic tissues where they promote cell lineage-specific differentiation and suppress cell division. Conversely, a variety of human cancers show elevated expression of Dlx genes and Dlx genes have been shown to have growth promoting effects in some tumourigenic cell types. We seek to understand the mechanisms of action of Dlx genes with respect to cell division during development in order to understand how their functions are altered in cancer cells. The successful applicant will gain experience in recombinant DNA manipulation, animal cell culture, gene expression analysis, and protein detection methodologies.

**Dr. Marc Coppolino, MCB**

Tumour cell invasion through extracellular matrix (ECM) is required for cancers to spread, and is dependent upon partial degradation of ECM components by matrix metalloproteinases (MMPs) secreted by tumour cells. A semester project is proposed to examine how the transport and targeted release of MMPs are regulated during invasion of ECM by breast cancer cells. The project will involve experimentation using cultured tumour cell lines, expression of GFP-tagged proteins, and cell-based assays to assess cell invasion.

**Dr. Mike Emes, MCB**

As well as being the major carbohydrate staple in our diet, starch consumption (high carbohydrate load) is a significant contributor to Type2 Diabetes. Resistant starches (RS) are digested less easily as they pass through the small intestine, reducing the glycemic index and having the additional benefit of stimulating regeneration of the lining of the large bowel, reducing the incidence of colorectal cancer. This project is concerned with understanding the regulation of starch branching enzymes in plants, which contribute to the glucose-polymer architecture and affect its digestibility. A wide range of biochemical, molecular and cell biological approaches will be used including electrophoresis, pcr, recombinant protein production, transgenesis and confocal microscopy. For more information about our research please see my [profile on the Departmental website](#).

**Dr. Nina Jones, MCB**

Multicellular organisms rely on signal transduction cascades to control important biological responses such as cell growth, differentiation and survival. Understanding the biochemical basis of these protein-protein interactions is of key importance in defining how particular mutations can contribute to pathological conditions such as cancer. In this summer research project, the student will aid in determining the signalling pathways that are mediated by several phosphotyrosine adaptor proteins by identifying the molecular components and biological functions associated with these proteins. Techniques such as DNA cloning, PCR, bacterial and mammalian cell culture, protein purification, electrophoresis, immunohistochemistry and microscopy will be employed by the student.

**Dr. David Josephy**

Targeted cancer therapy uses oral drugs to shut down specific cancer "drivers" - oncoproteins that cause uncontrolled cell division. One of the greatest successes of this approach has been the use of the drug
imatinib in chronic myelogenous leukemia (CML). Unfortunately, in many patients, imatinib resistance eventually develops. There is considerable evidence that glutathione transferase GSTT1 promotes imatinib resistance via a cell signalling mechanism. The student will use co-immunoprecipitation and LC-MS analysis to identify, in human liver cells, GSTT1 binding partners that act in cell signalling pathways.

**Dr. Rod Merrill, MCB**

Bacteria rely on virulence factors to facilitate diseases in plants, animals, and man. A recent, new strategy to combat infection in immunocompromised patients (cancer, burn, and AIDS) is to neutralize these factors by small molecule therapy, thereby helping to disarm the offending microbe rather than threaten its survival. Cell-based strategies for identifying and testing inhibitory compounds against virulence factors have the advantage of not requiring purification of the target protein, testing of inhibition in a cellular context, and selecting for compounds that possess useful pharmacokinetic properties. We recently identified a suite of compounds that function as potent in vitro inhibitors of mART toxins and these provide protection of both yeast and mammalian cells against DT-group mART toxins. These exciting results provide proof-of-principle that an inhibitor designed against mART toxins may be important for reducing the virulence of bacterial pathogens. The summer student will work on this project alongside a postdoctoral researcher to develop new therapeutics for treating infections in immune-compromised patients, such as those suffering from cancer.

**Dr. Richard Mosser**

Work in my lab is focused on understanding how hyperthermia triggers apoptosis and how the major heat-inducible protein, HSP70 prevents this from occurring. This project will examine the effect of hyperthermia on microRNA expression. microRNAs play critical roles in the regulation of stress responses. The expression of several apoptotic regulatory proteins is controlled by microRNAs that in many cases have altered patterns of expression in cancer. Recent work in my lab has demonstrated that hyperthermia alters the expression of a microRNA that plays a role in controlling the expression of key apoptotic regulatory proteins. As well, we have found that HSP70 overexpression can affect the expression of these microRNAs. These results suggest that HSP70 prevents stress-induced apoptosis by influencing the effect of hyperthermia on microRNA expression. The major goals of this project are to examine the mechanisms controlling miRNA expression and maturation in heat-stressed cells and how they are regulated by HSP70. These studies will reveal how proteotoxic stress affects the miRNA processing machinery and provide insight into how HSP70 prevents stress-induced apoptosis through protection of this vital process.

**Dr. Jim Uniacke**

Cancer is a complicated, multifactorial disease and the paths taken by cells en route to malignancy are highly variable. Yet, solid tumours share common features regardless of their tissue of origin or genetic makeup. These are referred to as the “tumour microenvironment” and include factors such as hypoxia (low oxygen availability), which has been linked to aggressive tumours and poor prognosis. My laboratory studies how hypoxic cancer cells synthesize proteins, and how these unique protein synthesis
Machineries can be targeted in cancer therapy to selectively disable tumour cells, leaving normal oxygenated cells unharmed.

Dr. Terry Van Raay

Many human diseases such as cancer mimic early developmental process, such as stem cell proliferation, migration and resistance to hypoxia to name a few. Studying these phenomenon in mammals is difficult, especially the earliest events, such as the initiation of the cancer stem cell. In my lab we use the early zebrafish embryo as an in vivo model to better understand the processes involved in disease initiation and progression. The ease of culturing zebrafish embryos, their transparency and the ability to manipulate their genome with CRISPRs has seen a dramatic increase in the use of this model for investigating human diseases. We are currently investigating the Wnt singling pathway, mutations in which are at the root cause of greater than 90% of all colon cancers. To do this, we use CRISPRs to knock out genes in this pathway to better understand their contribution to the singling pathway as a whole and to their involvement in cancer. Techniques we use in the lab involve micro-injection, micro-dissection, CRISPR design, PCR, qPCR, Western analysis and immunohistochemistry.