March 2018 (INNOV-18) Competition Awarded Innovation Grants

Listed by panel in alphabetical order

I1a Biomarkers and Genomics

Diamandis, Phedias
Princess Margaret Cancer Centre - UHN

Glioblastoma pharmacoproteomics: systematic proteomics-based profiling and chemical interrogation of glioblastoma

Glioblastoma is the most common type of brain tumour in adults. It is a very aggressive disease – most patients die within 15 months of diagnosis. Recently, researchers have been able to classify glioblastomas into different categories based on patterns in their DNA, however these groupings have not been helpful in predicting whether a tumour will respond to treatment or how well a patient will fare. Instead of classifying tumours based on their DNA, Dr Phedias Diamandis and his team will group them based on their proteins which he hopes will more useful in designing tailored therapies for patients. The researchers will use banked tumour samples to create in-depth protein profiles for each group and develop lab models to study how tumours within that group respond to different drugs. This is the first study to use protein profiles to identify and test new drug targets in glioblastoma which will guide the development of personalized treatments based on a patient's tumour classification.

Kislinger, Thomas
Princess Margaret Cancer Centre - UHN

Identifying the molecular landscape of the triple negative breast cancer cell surface proteome – an avenue for new therapies

Triple negative breast cancer (TNBC) accounts for 10-20% of all breast cancers but due to their aggressive and hard-to-treat nature, are responsible for a large proportion of breast cancer deaths. To date, no good biological markers have been identified for TNBC cells which has slowed the development of targeted therapies for this disease. In an effort to locate such markers, Dr Thomas Kislinger and his team are constructing a detailed atlas of the proteins on the surface of TNBC cells. In particular, they will look for proteins that are found in abundance on cancer cells but not on healthy cells. They will also study the function of these proteins which will help determine whether any of them can be targeted by new and existing drugs.

Marra, Marco
BC Cancer Agency (Vancouver)

Dissecting tumour heterogeneity using single cell genomics, epigenomics and transcriptomics

A tumour is not the same through and through. It is actually made up of many different cells. This mixed composition partly explains why some cancer treatments fail – the therapy can kill some cancer cells but not all. Those that survive continue to grow and eventually cause the cancer to return. Dr Marco Marra and his team are trying to get around this problem by studying individual cancer cells in more detail than was previously possible. They are developing and using groundbreaking, state-of-the-art technologies to examine the DNA in each cancer cell within a tumour. This will give them valuable insights into how tumours change and become resistant to treatment. These techniques and the knowledge gained from them will allow doctors to predict how tumours will grow and whether they can be treated with a specific drug, leading to better treatment options for patients.

Spreafico, Anna
Princess Margaret Cancer Centre - UHN

Oral and intestinal microbiome profiling in intermediate risk locally advanced head and neck squamous cell carcinoma patients receiving chemoradiotherapy and immunoradiotherapy

The complex community of bacteria and viruses living on and in us, known collectively as the microbiome, directly influence our health. They help protect us from disease and can also affect how well drugs work in our bodies. For the first time, Dr Anna Spreafico and her team are studying how the microbes living in the mouth and gut play a role in oropharyngeal cancer, a type of cancer that affects the back of the mouth and throat. They will collect samples from patients who are undergoing different treatments for oropharyngeal cancer. These samples will be collected at different times in the treatment process and will be taken from different parts of the body. The goal is to paint a clear picture of which microbes are present and whether they impact the effectiveness of anti-cancer therapies.

I1b Gene Regulation and Cell Biology

Garzia, Livia
The Research Institute of the McGill University Health Centre (RI-MUHC)

Evaluation of electrical activity as a tumour suppressor in medulloblastoma

Medulloblastoma is the most common brain tumour in childhood. Children with this cancer are treated with a combination of chemotherapy and radiation. While effective, these treatments are toxic and damaging to the developing brain and lead to serious cognitive side effects in survivors. Dr Livia Garzia and her team are exploring a brand new approach for medulloblastoma treatment that would not rely on chemotherapy or radiation. The researchers are testing the idea that faulty communications between neurons in the brain lead to cancer. Neurons are special brain cells that receive, process and send information within the brain and from the brain to other parts of the body. It's possible that in children who are vulnerable to brain tumours, their neurons cannot receive and process information properly which causes the cells to become a cancer. Based on this premise, Dr Garzia and her team will study different ways of restoring proper communication between neurons and how it impacts tumour development. There are already existing drugs that target faulty communications in neurons, which the researchers hope can be repurposed to treat medulloblastoma without the damaging side effects.

Gorrini, Chiara
Princess Margaret Cancer Centre - UHN

Targeting aryl hydrocarbon receptor as novel vulnerability in triple negative breast cancers

In triple negative breast cancer (TNBC), a very aggressive form of breast cancer with devastating effects in young women, cancer development and progression depend on the ability of tumour cells to protect themselves from damage caused by molecules called free radicals. Free radicals are typically produced as a normal end-product of cell growth and maintenance, but they can also result from chemotherapy. Dr Chiara Gorrini and her team are trying to develop new treatments for TNBC by making the tumours more vulnerable to free radical damage. The researchers previously discovered a protein that TNBC tumour cells rely on to protect against free radicals. They are now trying to understand how this protein works and how these systems could be targeted to improve TNBC therapies.

Laplante, Mathieu
l'Institut universitaire de cardiologie et de pneumologie (IUCPQ)

Defining a new link between oncogenic growth factor signalling, mitotic defects and chromosome instability

Chromosomes are the packaged form of DNA and can become unstable. Unstable chromosomes are at risk of losing chunks of DNA or having of random segments of DNA duplicated. Chromosome instability is a driving force behind many cancers and their resistance to chemotherapy. Dr Mathieu Laplante and his team are trying to understand why chromosomes become unstable. They found a new protein, which had never been described before, that seems to play a key role in chromosome instability. The researchers are now trying to understand how this protein affects the chromosome integrity and whether getting rid of this protein can prevent or reduce tumour formation.

Pratt, Christine
University of Ottawa

BRCA2-deficient fibroblasts in tumour promotion

When cells grow old and stop dividing or when their DNA is damaged, they release signals that lead to inflammation. When this happens in breast cells, particularly ones called fibroblasts, it can increase the risk of breast cancer. Dr Christine Pratt and her team are studying whether fibroblast cells from women with mutations in the breast cancer-associated BRCA2 gene are more likely to stop dividing and/or sustain DNA damage, leading to them give off more cancer-promoting signals. The researchers will also look at whether blocking these signals can prevent tumour formation.

Yamanaka, Yojiro
McGill University

Generation of platinum-resistant ovarian cancer mouse model to study susceptible cell populations in the fallopian tube epithelium

High-grade serous ovarian cancer (HGSOC) is the most common and lethal type of ovarian cancer. One in 5 cases of the disease are completely resistant to chemotherapy. For these patients, no effective treatments exist. Despite its lethality, we know very little about how this cancer starts and develops. This is largely because there are no good animal models in which to study this disease and most patients are diagnosed at a late stage. Using innovative genetic engineering technologies, Dr Yojiro Yamanaka and his team will create the first mouse model of HGSOC that will allow them to study the cancer at its very early stages and as it progresses. By understanding how HGSOC begins, we can create and test new strategies for prevention and early detection.

I2 Imaging and Technology Development

Kuruvilla, John
Princess Margaret Cancer Centre - UHN

Engineering novel 3D hydrogels to better characterize molecular cues and cellular dynamics in the lymphoma microenvironment

To study cancer in the lab, researchers often grow cancer cells in a single layer in a Petri dish. While this can provide useful information about how cells grow, it doesn't fully replicate the real conditions of a tumour within the body. The unique microenvironment surrounding a tumour is made of both cancer cells and healthy cells that have been manipulated by the tumour for its own growth. These healthy cells provide nutrients to feed the growing tumour and serve as a protective barrier against anti-cancer therapies. To better understand the tumour microenvironment and how we can get around it, Dr John Kuruvilla and his team are creating 3D models of tumours in the lab which will more accurately represent tumour conditions in the body. They will use their models to study how cancer cells co-opt healthy, neighbouring cells to serve their needs and how that can be prevented. Many drugs that seem promising in standard laboratory tests fail in later stages of testing because they are unable to get past the tumour microenvironment. Dr Kuruvilla's 3D model will allow researchers to test new drugs in a more accurate model so that the most promising therapies can be identified with more confidence early on.

Lu, Qing-Bin
University of Waterloo

Development of novel combination therapy of cisplatin with a molecular promoter to treat multiple cancers

Cisplatin is one of the most widely used drugs for cancer treatment, however it has two main drawbacks: severe toxic side effects and resistance to the treatment. These drawbacks pose a significant challenge to expand the use of cisplatin to more patients. Dr Qing-Bin Lu and his team are tackling these obstacles by using ultrafast laser technology to watch, in real time, anticancer drugs attack cancer cells. Using this innovative new technique, the researchers uncovered the way in which cisplatin kills cancer cells. They will know use this knowledge to identify new molecules that, when paired with cisplatin, will enable the drug to be delivered selectively to tumours at a lower dose. This will help minimize the harsh side effects of the drug while improving its effectiveness.

Moraes, Christopher
McGill University

Reconceptualizing cancer metastasis as a balance of intra-tumoural mechanical forces

Tumours are generally described as inert lumps but that is not true at all. Cells within the tumour are constantly active, pushing and pulling on each other and elements of their environment. A tumour is similar to a balloon with the cells on the outside pulling against each other to generate mechanical forces that keep the cells on the inside tightly squeezed. Dr Christopher Moraes and his team are exploring the idea that an imbalance in the mechanical forces within a tumour play a triggers cancer spread. They are developing new tools that will allow them to measure the strength of these forces and manipulate them. Using these techniques, they will be able to determine whether an imbalance in these forces directly cause cancer cells to spread. This knowledge could lead to new diagnostic tools that can identify early on which tumours are likely to spread, creating more opportunities for early preventive treatment.

Turcotte, Eric
Université de Sherbrooke

Early detection and in vivo estrogen receptor status determination of uterine and ovarian cancers using the novel PET tracer 4FMFES: a phase I/II study

Ovarian and uterine cancers are often detected at a late stage because the disease does not have symptoms early on and there aren't precise screening and detection tools available. Dr Eric Turcotte is hoping to change that. He is conducting a clinical trial to test whether a new imaging method can accurately detect these two types of cancer. This technique was recently shown to be effective at detecting breast cancer and even breast cancer that had spread to other sites. Dr Turcotte and his team are adapting the technique to be able to detect ovarian and uterine cancers early. The technique can also tell if the cancers are sensitive to hormone therapy, which will help doctors develop a targeted treatment plan for patients.

I3 Immunology, Signalling and Stem Cells

Bridle, Byram
University of Guelph

Combining oncolytic virotherapy and epigenetic modifiers to treat acute leukemias

Acute leukemias have high mortality rates in adults and infants and are also the most prevalent cancers in children. Successful treatments for leukemias typically require several years of intensive therapy. Dr Byram Bridle and his team are developing a new treatment that combines cancer-killing viruses with a type of drugs called epigenetic modifiers. In earlier work, the researchers found that pairing these 2 therapies boosted their effectiveness against acute leukemias and cured mice of the disease. They are now trying to understand how the 2 treatments work together and what the best dosing would be. Dr Bridle is also studying whether this treatment strategy is effective against leukemias in the brain and spinal cord, a nearly-always fatal form of the disease.

Kubes, Paul
University of Calgary

The cavity macrophage, a friend or foe in cancer metastasis progression

Every organ in the body lives in a cavity which, until recently, was thought to be an empty space. Dr Paul Kubes and his team discovered that these cavities are filled with a type of specialized immune cell called the GATA6+ macrophage. They found that these macrophages have tremendous powers to repair damaged tissues and are able to enter tissues directly. When the tissue contains a tumour, though, these healing powers result in the tumour receiving more nutrients and growing faster. Building on this knowledge, Dr Kubes is now leading the world's first study to study the impact of these healing macrophages on tumour growth. His team will use powerful microscopes to observe these cells as they enter tumours and encourage them to grow. They will also look for ways to prevent these macrophages from invading tumours as a way to slow tumour growth.

Perreault, Claude
Université de Montréal

The proteogenomic landscape of tumour-specific antigens present in triple-negative breast cancers

Dr Claude Perreault and his team are trying to develop a vaccine to treat breast cancer. In order for a vaccine to be successful, it must be able to tell breast cancer cells apart from healthy, non-cancerous cells. As a first step towards creating a vaccine, Dr Perreault is searching for unique markers present only on breast cancer cells that can be recognized by the immune system. The researchers will use a combination of advanced techniques to find these markers specifically in triple negative breast cancers, the most deadly type of breast cancer. These breast cancer-specific markers have never been discovered in humans before and would represent a significant step forward in the creation of a therapeutic vaccine.

Shmulevitz, Maya
University of Alberta

Multi-mechanistic oncolytic reovirus variants for clearing cancer

Dr Maya Shmulevitz is studying a cancer-killing virus called reovirus. This virus holds promise as a way to treat breast cancer because it can specifically target breast cancer cells and does not have toxic side effects. Ongoing clinical trials have shown that while reovirus can help patients with breast cancer live longer, it doesn't fully cure them of the disease. Dr Shmulevitz and her team plan to improve reovirus as an anti-cancer treatment by genetically engineering it to have three new traits. These features will allow the virus to get inside breast cancer cells more easily and grow faster while protecting the virus from being turned off by the cancer cells. The researchers will test different strains of the virus to find the most effective combination for killing cancer cells.

I4 Novel Therapeutics

Berman, Jason
IWK-Grace Health Centre

An in vivo model to study gold-nanoparticle aided radiotherapy using a photon beam generated from a low Z target

Nearly half of all cancer patients receive radiation as part of their treatment. While effective, radiation often damages the healthy tissue surrounding the tumour which limits the amount of radiation that can be safely given. Dr Jason Berman and his team are trying to overcome this problem using tiny molecules called nanoparticles. They developed a new method of delivering radiation that uses nanoparticles to multiply a low dose into a much higher dose. The researchers will test their new radiation technique in a freshwater fish called a zebrafish. If successful, this strategy could lower the radiation dose needed to treat many cancers, which would reduce radiation-related side effects such as the development of secondary cancers. For cancers like pancreatic cancer which are currently difficult to treat with current radiation dosing, this strategy would allow patients to receive higher amounts of radiation in a safer way that minimizes long-term side effects.

Carreno, Sebastien
Université de Montréal

Identification of anti-metastatic compounds that blocks ezrin activity

Most cancer deaths are caused by metastasis, when cancer has spread beyond its original site to other places in the body. The ERM family of proteins are important for cancer spread because they allow cancer cells to change their shape, grow and move. Dr Sebastien Carreno and his team are trying to prevent cancer metastasis by looking for drugs that block ERM proteins. They will focus specifically on drugs that can target these proteins to stop breast cancer progression and spread. To do this, they developed a new technique that enables them to see whether or not the ERM proteins are active. This innovative technology will allow them to search through hundreds of compounds at the same time to find ones that can block ERM proteins and prevent cancer spread.

Diallo, Jean-Simon
Ottawa Hospital Research Institute

Novel oncolytic virus vaccines exploiting dendritic cell targeting

By training our immune system to recognize and destroy cancer cells, therapeutic vaccines represent a new area of cancer treatment. Dr Jean-Simon Diallo and his team are developing a pipeline to create personalized cancer vaccines. These vaccines combine cancer-killing viruses with molecules that target specific immune cells to turn on a long-lasting, anti-cancer immune response. To do this, they will take a patient's own tumour cells, infect them with a specially designed cancer-killing virus and turn them into a vaccine. As a first step, they will test their innovative approach in mice with colon cancer and melanoma but if proven, this vaccine strategy could be used to treat all types of cancer.

Greer, Peter
Queen's University

Development of a biosensor for high throughput screening of novel compounds targeting ezrin for breast cancer therapy

A few years ago, Dr Peter Greer's team discovered that cancer cells with high levels of a protein called ezrin are more likely to become resistant to chemotherapy and spread to other parts of the body. The ezrin protein can change its shape between an off form and an on form where it exerts its cancer-promoting effects. Dr Greer and his team have used this knowledge to create biological sensors that can detect whether the ezrin in a cancer cell is in the on or off state. Using these new tools, the researchers are searching for drugs that can lock ezrin in the inactive form which could help prevent cancer spread and treatment resistance. They will choose promising drugs for further testing to confirm their effects in cancer cells in the lab.

Ilkow, Carolina
Ottawa Hospital Research Institute

Oncolytic immunotherapy-driven synthetic lethality

Cancer-killing viruses are a new and exciting class of anti-cancer therapies that work by killing cancer cells directly and by turning on the patient's own immune system to fight cancer. These new therapies are showing moderate but promising benefits to cancer patients in early clinical trials. Dr Carolina Ilkow and her team are using a 2-pronged approach to improve the effectiveness of these viral therapies. They will arm the virus with drugs that will make the cancer cells more vulnerable to other targeted therapies given at the same time. This innovative approach hits the tumour at multiple target sites to increase the likelihood of success while reducing the risk of side effects.

Stagg, John
Université de Montréal

Immune-stimulatory antibody-drug conjugates for treatment of breast cancer

One in five women with breast cancer is treated with Herceptin but for many of these women, the therapy becomes less effective over time. Dr John Stagg and his team have previously shown that immunotherapy can enhance Herceptin's anti-cancer effects. The researchers will be studying a type of drug called demethylating agents which are known to stimulate the immune system. Their idea is to use the immune-boosting effects of demethylating agents to strengthen the cancer-killing effects of Herceptin. To test their idea, the researchers will use state-of-the-art chemistry to create fusion drugs consisting of Herceptin attached to a demethylating agent. This new treatment strategy could help patients for whom Herceptin is not working well to reap the full benefits of this powerful drug.

Stirling, Peter
BC Cancer Agency (Vancouver)

Promoting hypermutated genomes as a therapeutic strategy

Cancer cells can be recognized and eliminated by the immune system of a person with cancer, just like when our cells become infected with a virus. This process can be inefficient because cancer cells are so similar to normal cells, which can make them difficult to find for our immune system. Our immune system finds cancer cells based on changes in their DNA –the more changes it has, the easier it is for the immune system to find it. Dr Peter Stirling and his team are building on this knowledge to improve the efficiency of immunotherapy, a treatment that uses the patient's own immune system to fight cancer. They are looking for chemical treatments that can deliberately cause DNA changes in cancer cells so that these cells can be more easily detected and destroyed by the immune system. This strategy could be used to improve treatment response in many different cancer types.

I5 Prevention and Quality of Life

Cafazzo, Joseph
The Toronto Hospital (General Division) - UHN

A virtual prostate cancer clinic for enhanced survivorship care

Men with prostate cancer are living longer because of earlier cancer diagnoses and better treatment options. However, after treatment, patients have to deal with long-term side effects that have a large impact on their quality of life. Dr Joseph Cafazzo and his team are using technology to improve follow-up care for both the patients receiving it and the doctors delivering it. The researchers will study how follow-up care is currently being offered and learn how it can be improved. They will consult patients and doctors to understand the best follow-up experience from their points of view. Using all this information, the researchers will design and develop a virtual prostate cancer clinic that addresses the changing needs of patients as they move through their cancer journey. By giving patients access to virtual services, the researchers hope to cut down on wait times and help patients better manage their prostate cancer to achieve a higher quality of life.

Grandy, Scott
Dalhousie University

EXercise to prevent AnthraCycline-based Cardio-Toxicity (EXACT 2.0) in individuals with breast cancer

Anthracyclines are a type of chemotherapy drug that is often used to prevent breast cancer from coming back after surgery. While effective, these drugs are also known to cause damage to the heart, which can lead to a decline in heart health and complications such as heart failure. Lab studies have shown that exercise can offset some of the heart-damaging effects of anthracyclines. Dr Scott Grandy and his team will study the impact of an exercise program on heart health and quality of life in patients with breast cancer who are receiving anthracyclines. They will use medical scans and blood tests to observe how well the heart is working. The results from this study will help improve the long-term health and quality of life of patients with breast cancer who take this drug.

Prado, Carla
University of Alberta

Maximizing metastatic breast cancer patient outcomes using diet and exercise

In Canada, the 5-year survival rate for metastatic breast cancer is 4 times lower than that for early stage breast cancer. The main reason for this is that the available treatments such as chemotherapy are not effective for breast cancer that has spread. Dr Carla Prado and her team will determine whether practical changes in diet and exercise before chemotherapy can improve how well the treatment works in women with metastatic breast cancer. The researchers will look for changes in tumour size and improvements in treatment side effects and overall survival. If effective, this strategy could offer patients a safe and accessible way of maximizing their chemotherapy's effectiveness.