

medicine gets personal
2014 UHN research report



UHN Research Snapshot

Total Researchers	883
Fellows	675
Graduate Students	767
Total Trainees	1,442
Support Staff	1,628
Research Space	981,953 sq. ft.
Publications	2,910
Total Funding	\$344,384,007

University Health Network (UHN) comprises four hospitals: Princess Margaret Cancer Centre, (PM Cancer Centre), Toronto General Hospital (TGH), Toronto Rehab (TR) and Toronto Western Hospital (TWH). It also has five research institutes: PM Cancer Centre, Techna Institute for the Advancement of Technology for Health (Techna), Toronto General Research Institute (TGRI), Toronto Rehabilitation Institute (TRI) and Toronto Western Research Institute (TWRI). The scope of research and complexity of cases at UHN have made it a national and international source for discovery, education and patient care. UHN is a research hospital affiliated with the University of Toronto (UT) and is a member of the Toronto Academic Health Science Network (TAHSN).

Cover Image: Kwan Ho Tang, PhD, Postdoctoral Fellow, Princess Margaret Cancer Centre, University Health Network

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Making Medicine Personal



Robert Bell MDCM, MSc, FACS, FRCSC, President and Chief Executive Officer, UHN

Christopher Paige PhD, FCAHS, Vice President, Research, UHN

Recent advances in our understanding of human biology have set in motion a potential revolution in health care based on an individual’s unique makeup. The best ways to acquire and integrate personal information into medical practice comprise major challenges to UHN’s research teams.

Medicine has always been personal—at some level—whether or not we knew it.

First, we each have a personal array of genes: our genome. Sometimes these genes are defective from birth, leading to diseases that may be mild to catastrophic. More commonly, genes mutate over the course of our lives; most mutations are inconsequential, but some lead

to serious diseases like cancer. Acting on this knowledge remained nearly impossible until the advent of fast and accurate methods to determine the genetic makeup of normal and cancer cells, and the discovery of drugs that target particular mutations. Our research teams are developing ways to integrate this information into medical practice. Clinical trials focused on integrating molecular profiling of tumours into cancer diagnostics and treatment are already well underway.

At a different level, what could be more personal than when your immune cells attack your own tissue? This occurs in autoimmune inflammatory diseases such as rheumatoid arthritis, inflammatory

bowel disease and multiple sclerosis. While there have been major advances in treating these conditions, we still do not know why some patients respond to one anti-inflammatory drug while others do not. UHN research teams are discovering new ways to predict response and tailor interventions for these patients.

A bold example of personalized medicine is growing new tissue from a person's own cells. UHN researchers have established protocols to grow heart cells to replace damaged tissue, insulin-producing cells to control diabetes and cartilage-producing cells to improve damaged joints. New imaging technologies are also being developed to monitor these cells in the body, which is critical for their use in the clinic. These early steps portend an entirely new approach to treating disease.

Making medicine personal at UHN goes far beyond cells, molecules and tissues.

Can there be anything more personal than talking to your surgeon as an electrode is inserted into your brain? UHN has pioneered deep brain stimulation for movement disorders, depression, Alzheimer disease and other disorders. Because each brain is unique, dialog between patient and surgeon helps pinpoint the exact location of the electrode, transforming the patient into a key member of their own surgical team.

Ultimately, making health care personal means putting the patient first. At UHN, integrated care teams bring together health professionals and patients with the aim of optimizing care and improving the patient

experience. Collaborative practice for a patient recovering from stroke brings together individuals skilled in acute care, and experts in rehabilitation and patient/family education.

A critical issue is to determine if personalized medicine is affordable—or if it is, in fact, the only way to make health care sustainable. In the long run, will customized treatments save money through greater efficiency and fewer subsequent visits? UHN researchers are studying the effect of personalized approaches on the health care system and beyond. These studies will guide policy makers on the most effective use of our health care dollars and help health care providers to better use existing resources.

Even with our four hospitals, five research institutes and four foundations (The Princess Margaret Cancer Foundation, Toronto General & Western Hospital Foundation, Toronto Rehab Foundation, Arthritis Research Foundation), UHN cannot progress fast enough on our own to meet our lofty goals. Fortunately, we are helped enormously by our partnership with the University of Toronto and the other research hospitals in the Toronto Academic Health Science Network. Working with these colleagues and others in Canada and around the world, UHN researchers are improving health care at multiple levels by making medicine personal.



Brightening the Brain

Using imaging to understand the science of sadness

Depressive disorders exert huge tolls on society through health care-related costs and lost productivity. Moreover, it is very difficult to predict which treatments will benefit which patients. In fact, very little is known about why some individuals respond well to certain treatments, while others do not. To address this issue, Dr. Jonathan Downar investigated whether individual patient response to repetitive transcranial magnetic stimulation (rTMS) could be predicted by imaging the brain using functional magnetic resonance imaging (fMRI). rTMS treatment for depression uses powerful, focused magnetic field pulses to alter activity within emotion-regulating brain regions.

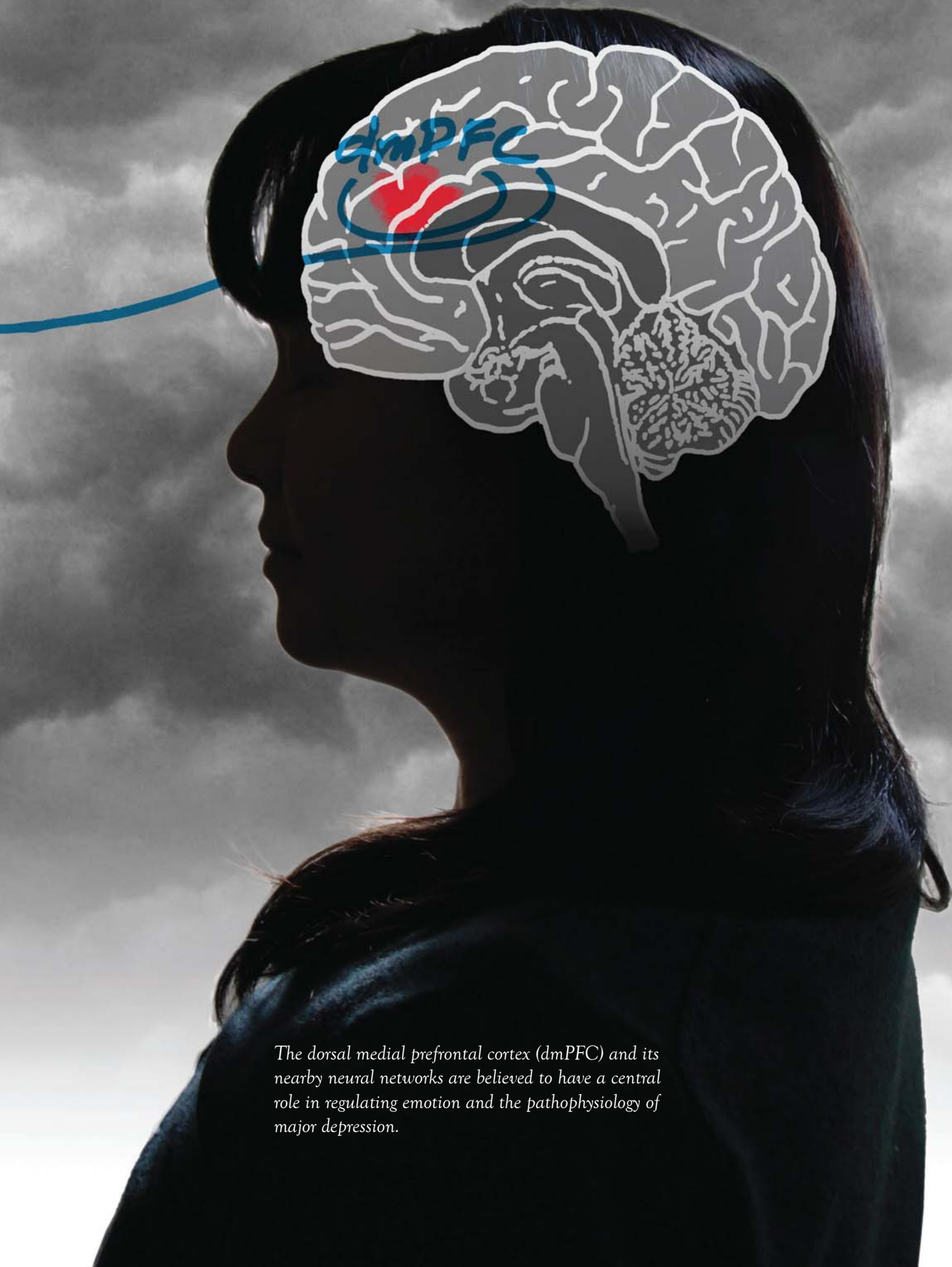
Brain maps were created for 25 patients before and after rTMS treatment. About half the patients showed a positive response to treatment, while the other half had little improvement. After analyzing the fMRI images, Dr. Downar's team found that patients that responded well to rTMS had high connectivity within specific circuits in the frontal lobes of the brain. These regions have been previously linked to depression and, on a functional level, are involved in self-regulation of thoughts, feelings and behaviour.

This study provides important new insights into the underlying neurobiological mechanisms that indicate which individuals may respond better to rTMS treatment and brings researchers one step closer to better customizing rTMS for different patients.



Measuring brain connectivity could be used to ensure that individuals are provided with therapies that benefit them the most.

Salomons TV et al. Neuropsychopharmacology 2014 Jan. Supported by Ontario Brain Institute, Canadian Biomarker Integration Network for Depression, Buchan Family Foundation and Toronto General & Western Hospital Foundation.



The dorsal medial prefrontal cortex (dmPFC) and its nearby neural networks are believed to have a central role in regulating emotion and the pathophysiology of major depression.

Making Hepatitis C History

Tailoring a cure to each patient's infection

Over 180 million people worldwide are infected with the hepatitis C virus (HCV). The virus causes progressive damage to the liver that can lead to liver failure or liver cancer. Traditionally, HCV infections are treated with a combination of medications for up to a year that can cause serious side effects yet have relatively low cure rates. A person's response to these medications varies and depends on age, race, the strain of virus, the amount of virus in the blood and the extent of liver damage.

In the past two years, significant progress has been made in the fight against HCV; researchers have identified several drug combinations that are highly effective at curing HCV infections. One of these drug combinations was evaluated in a study led by Dr. Jordan Feld.

The study enrolled over 600 patients who had never been treated previously and were infected with genotype 1 HCV, the most common strain of the virus. Participants received either the new therapeutic regimen or a placebo—pills containing no medicine—for 12 weeks. Overall, 96% of patients treated with the new regimen were cured of their infection and the pills were tolerated well with only mild side effects.

HCV leads to more years of life lost than any other infectious disease in Ontario and is the most common cause for liver transplantation. With this new treatment regimen and others in development showing extremely high cure rates with relatively few side effects, eliminating HCV infection from Canada is now possible.



Eliminating a disease is a rare opportunity in medicine. These new treatments make it possible to move towards an HCV-free Canada.

Feld JJ et al. N Engl J Med. 2014 April. Supported by Toronto General & Western Hospital Foundation and AbbVie.



Representative heat map of Canada showing total HCV cases per province (red >100,000 ; orange >25,000; green <1,000; data from Public Health Agency of Canada, 2007). The new therapeutic regimen, represented by the blue pill, could help eliminate the virus.

The Artistry of Gene Analysis

A new tool to aid in the discovery of cancer-causing genes

Cancers arise due to spontaneous changes in DNA, which accumulate over time and cause unrestricted cell growth. The accumulation of these changes makes it challenging to ascertain which ones initiated the cancer.

To bypass this problem, researchers normally introduce DNA errors into cells and then use the cells as a tool for identifying cancer-causing genes. However, this has only been successfully achieved using cells from zebrafish and mice. Recent efforts by Dr. Rama Khokha's laboratory have provided a powerful new method to address this gap. Using several cutting-edge genomic techniques, they successfully introduced traceable genome-wide DNA errors into normal human cells.

The team used a new combination of retroviruses and short DNA sequences to insert DNA at random sites across the genome. This rapidly transformed the normal cells into tumour cells with DNA alterations comparable to those found in many human cancers.

Detailed genomic analyses of these newly generated tumours yielded 80 candidate genes with the potential to drive cancer growth. Importantly, one of the genes was defective in at least one in ten of the tumours that were generated. This gene is known to be involved in regulating DNA organization and has previously been shown to suppress cell growth.

As Dr. Khokha explains, "Our results reveal the potential for using viruses and transposons to rapidly uncover new cancer-causing targets. This will accelerate the global effort to decipher the genes, pathways and networks that drive cancer development and growth."



Uncovering the genetic elements that cause cancer will help us develop customized treatments to meet each patient's needs.

Molyneux SD et al. Nat Genet 2014 Aug. Supported by Ontario Institute for Cancer Research, Canadian Cancer Society Research Institute and PM Cancer Foundation. T Mak is a Tier 1 Canada Research Chair in Inflammation Responses and Traumatic Injury.



The Road to Recovery

Customizing stroke rehabilitation one step at a time

For those recovering from a stroke, walking using each side of the body equally (ie, symmetrically) can be a challenge. This ‘gait asymmetry’ is due to impaired movement control on one side of the body, a common stroke-related condition. While a frequent rehabilitation goal is to restore symmetry, there are few studies on how gait asymmetry changes with rehabilitation, making it difficult to know which approach works best in which patient.

To address this, Dr. Kara Patterson followed the individual progress of stroke rehabilitation inpatients over two years. Patients showed robust improvements in controlling leg movements, balance and overall mobility. However, over 80% of those with gait asymmetry did not improve in symmetry of either length or timing of steps taken by each side when walking.

People with gait asymmetry could be at risk for further complications, such as loss of bone density in the compromised limb or injury to the functioning limb. This study reveals a need to re-evaluate rehabilitation programs after stroke and place more attention on restoring gait symmetry.

“Although movement control improves after rehabilitation, gait asymmetry persists in stroke patients,” says Dr. Patterson. “This suggests that there are other unknown underlying causes that need to be targeted during rehabilitation and coupled with individualized feedback for each patient. Such customized programs could help patients to correct their gait using approaches that work best for them.”



Tailored rehabilitation solutions could help patients regain the full use of both sides of their body after a stroke.

Patterson KK et al. Neurorehabil Neural Repair. 2014 May. Supported by Heart & Stroke Foundation (Focus on Stroke personnel award), Canadian Stroke Network, Canada Foundation for Innovation, Ontario Innovation Trust, Ministry of Research and Innovation, and Toronto Rehab Foundation.





Good Things in Small Packages

Nanoparticle turns laser light into cancer-killing heat

Photothermal therapy is a promising treatment option in cancer. It works like this: a nanoparticle converts laser light into localized heat that kills nearby cancer cells. Gold nanoparticles are currently used for photothermal therapy, but they are non-biodegradable and have toxicity concerns.

An emerging alternative nanoparticle is the porphyrin, which is biodegradable and as effective as gold in transforming laser light into heat energy. An added benefit is that porphyrins may accumulate in tumour tissue, which along with the precision of laser light delivery, ensures that healthy cells remain unharmed. Unlike a metal such as gold, porphyrins can break apart and lose their ability to convert light into heat under sustained high-intensity light.

Dr. Gang Zheng and his team are leading the race to develop porphyrins for cancer therapy. Recently, they created a porphyrin loaded with manganese particles. They found that these porphyrins are non-toxic, have excellent photothermal properties and are highly stable (able to maintain their photothermal ability even after prolonged light exposure).

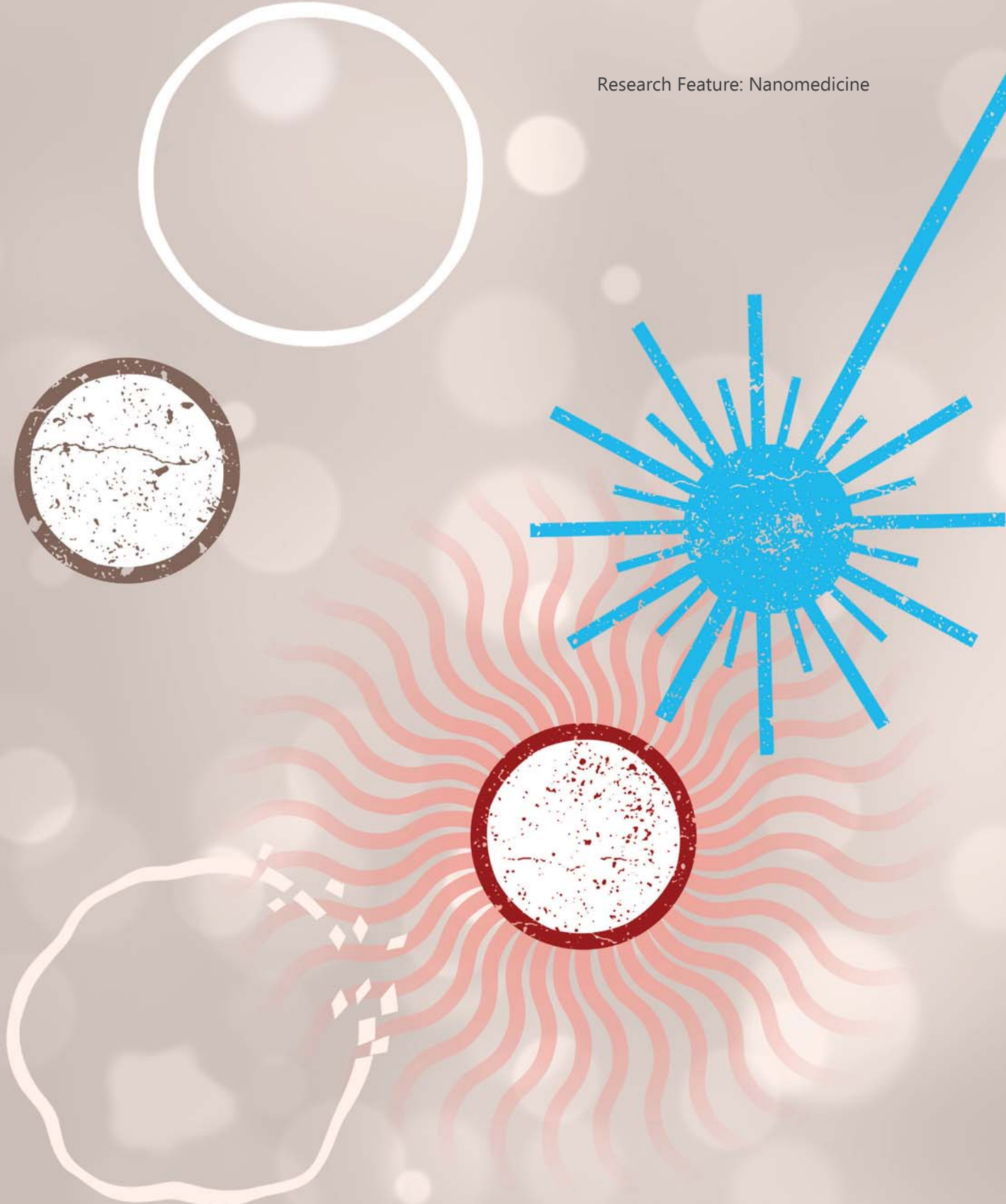
Adding manganese also makes these particles detectable by MRI. This has important implications for image-guided therapy, as porphyrins can be used to simultaneously visualize tumours and apply treatment in real time.

This porphyrin is a valuable new tool for personalized therapies that could be used to target a variety of difficult-to-treat cancers.



Through its multiple capabilities, the porphyrin can help visualize and kill tumours.

MacDonald TD, et al. Angew Chem Int Edit. 2014 Jul. Supported by Ontario Institute for Cancer Research, Natural Sciences and Engineering Research Council of Canada, Canadian Institutes of Health Research, Canada Foundation for Innovation and PM Cancer Foundation. G Zheng holds the Joey and Toby Tanenbaum/Brazilian Ball Chair in Prostate Cancer Research.



Cancer cells close to laser-excited porphyrins are killed. Both the location of the laser and the ability of porphyrins to be targeted to tumours allows for the treatment to be tailored to each patient.

Better Health Through Chemistry

Expanding medicinal chemistry at UHN

Basic research provides insights into the mechanisms, pathways and genetics of human diseases. These insights power a new way of developing therapies known as rational drug design: seeking out substances capable of affecting disease pathways to provide therapeutic benefits to patients. Whether it is to block an enzyme in a cancerous tumour or to prevent the build-up of plaques in the brain that cause Alzheimer disease, new drugs hold great promise for the future of health care.

Between the discovery of a disease pathway in the lab and the first clinical trial of a new drug is a critical effort by medicinal chemists to find chemicals that have the desired effect. By strategically designing small molecules to interact with a biomolecular target, medicinal chemists must identify and optimize a compound that is 'drug-like'—a compound that safely influences the molecular target in the body, while avoiding the creation of toxic side-effects.

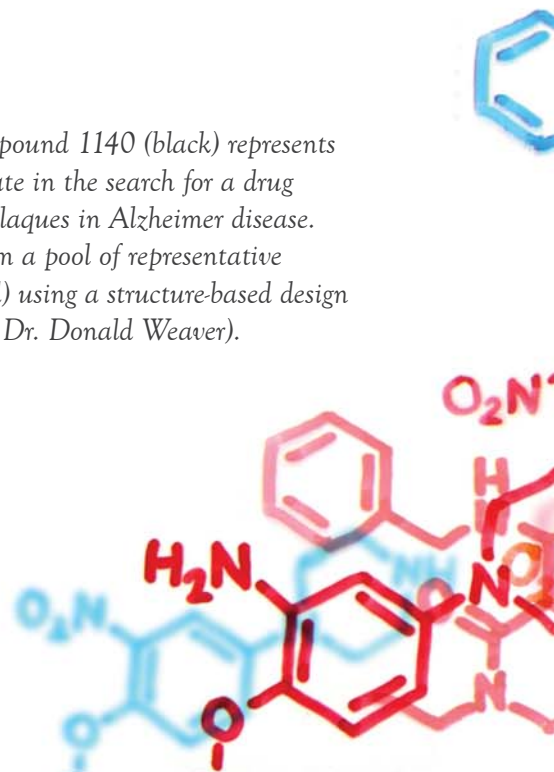
UHN's drug discovery efforts received a major boost last year with the launch of a new medicinal chemistry facility at TWRI headed by Dr. Donald Weaver, a medicinal chemist and neurologist who has led several successful drug design programs. The facility provides computational resources for drug design and modelling; and facilities for the biological screening and preclinical development of candidate drugs.

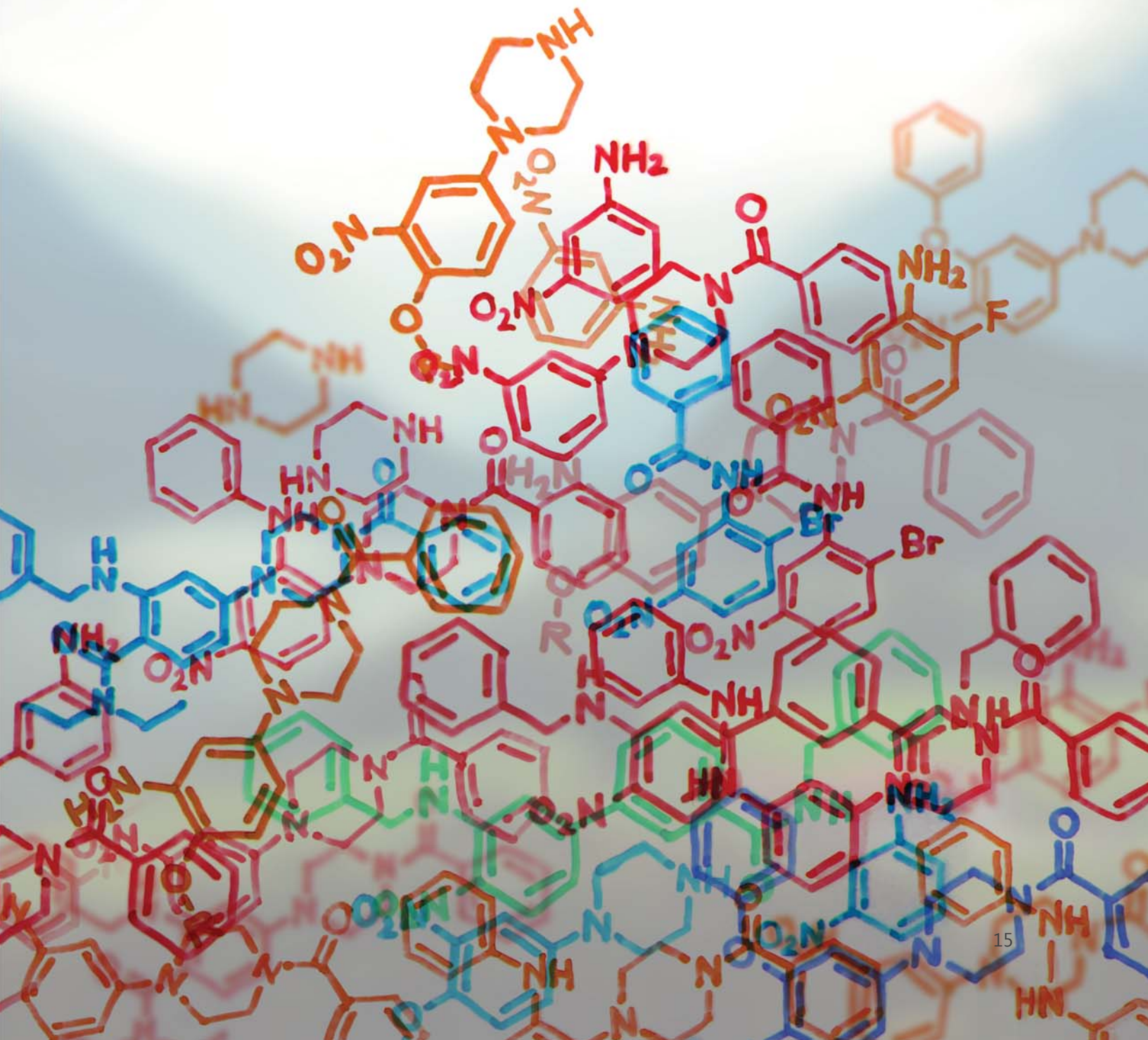
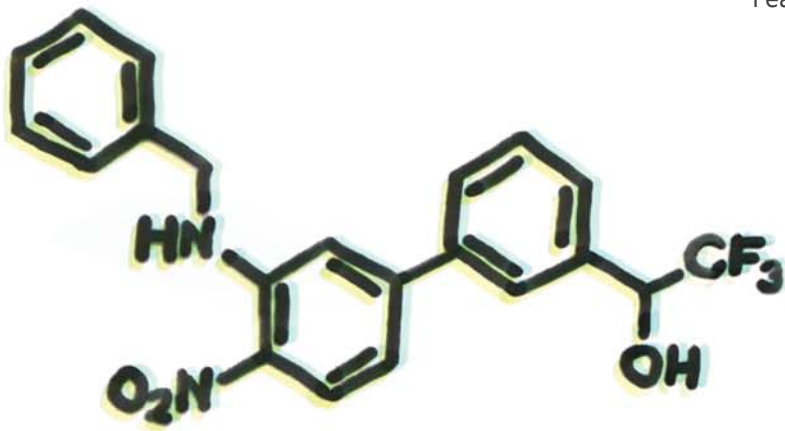
This new facility complements existing UHN medicinal chemistry capabilities that include the Therapeutics Group at

the Campbell Family Institute (led by Dr. Henry Pauls, Director, Medicinal Chemistry) and the Center for Molecular Design and Preformulations (led by Dr. Lakshmi Kotra, Director). These facilities collaborate with UHN researchers to provide the specialized computer simulations, chemical synthesis and detailed analysis needed to develop a new drug. Adding a new dimension to these facilities is UHNShanghai, a foreign enterprise wholly owned by UHN, that synthesizes chemical reagents and pharmaceutical intermediates for use in research and development services worldwide.

Medicinal chemists help transform biological insights into innovations that improve health for Canadians.

Image caption: Compound 1140 (black) represents the pinnacle candidate in the search for a drug to prevent harmful plaques in Alzheimer disease. It was optimized from a pool of representative compounds (coloured) using a structure-based design program (courtesy of Dr. Donald Weaver).





Year in Discovery

A selection of high-impact research at UHN



Earlier Detection of Leukemia

A team of scientists led by Dr. John Dick identified a mutation in the protein known as DNMT3 α that is linked to the development of acute myeloid leukemia (AML). AML is a cancer that grows in bone marrow and interferes with the production of normal blood cells. The identification of DNMT3 α mutations as a pre-leukemic marker could lead to earlier detection and improved strategies for the treatment of AML. *Shlush LI et al. Nature. 2014 Feb.*



A Better Treatment for HIV

A superior treatment for human immunodeficiency virus (HIV) was discovered. The new drug dolutegravir, along with the drug combination of abacavir and lamivudine, was found to be more effective and had fewer side effects than the currently recommended treatment for HIV. The clinical trial was led by Dr. Sharon Walmsley, who is currently studying the efficacy and safety of this new drug combination over a longer time period. *Walmsley SL et al. N Engl J Med. 2013 Nov.*



Improving Quality of Life

The results of a clinical trial led by Dr. Camilla Zimmermann suggest that early palliative care can significantly enhance the quality of life in patients with advanced cancer. Better quality of life, including reduced emotional distress and physical pain, can improve compliance with medical treatments and relationships with caregivers. Patients with cancer typically have a reduced quality of life, which worsens with progression of the disease. *Zimmermann C et al. Lancet. 2014 May.*



Inflammation in Diabetes

Inflammation mediated by macrophages (a type of blood cell) contributes to the development of type 2 diabetes (T2D). By altering the activity of a subset of nerves, Dr. Minna Woo and her team promoted the anti-inflammatory activity of macrophages, which prevented the onset of T2D in an experimental model. Inducing the anti-inflammatory state of macrophages may represent a powerful new strategy to prevent and treat T2D. *Wang L et al. Nat Med. 2014 May.*



From Drug Discovery to Clinical Testing

A possible anticancer therapy has been discovered by scientists at the Campbell Family Institute. Dr. Tak Mak and his team identified the enzyme PLK4 as a new cancer target. The finding led to the identification of CFI-400945 as a potential anticancer drug. Administration of CFI-400945 inhibited the activity of PLK4 and reduced tumour growth in mice. Clinical testing is now evaluating the drug's ability to reduce solid tumour growth. *Mason JM et al. Cancer Cell. 2014 Aug.*



Dealing with Stress to Prevent Cancer

Blood is sustained by hematopoietic stem cells (HSCs) that survive for long periods of time and are able to self-renew. Because of their longevity, HSCs are exposed to stressful stimuli, like fluctuations in nutrient levels and toxic substances, that can damage cells and make them cancerous. Dr. John Dick and his team recently revealed the cellular mechanism that maintains a healthy HSC pool by clearing individual cells that have been damaged by stress. *van Galen P et al. Nature. 2014 June.*



Discoveries to Reality

A selection of UHN commercialization milestones



2013 UHN Inventors of the Year

The recipients of UHN's Inventor of the Year award are scientists who have demonstrated an outstanding ability to apply biomedical research towards the creation of new, inventive and patient-oriented technologies, products and therapeutics. The 2013 award was presented to two recipients: The Campbell Family Institute's Drug Development Team (led by Dr. Tak Mak) for the development of multiple new cancer therapeutics; and Dr. Ralph DaCosta for a device that can detect bacterial infections in wounds.

The Campbell Family Team developed multiple new cancer drugs that are in or are nearing clinical trials. The most recent drug, CFI-400945, shows preclinical efficacy in the difficult-to-treat 'triple negative' form of breast cancer. Their research has also led to licensing agreements and the founding of several spin-off companies (eg, Miikana, Agios). These discoveries are

major contributions to the cancer treatment landscape.

Dr. DaCosta invented a handheld optical imaging device that detects the quantity and distribution of bacteria in wounds. It can deliver results at the point of care, enabling clinicians to make informed decisions in real time. This inexpensive device may also help to revolutionize wound care in developing countries.

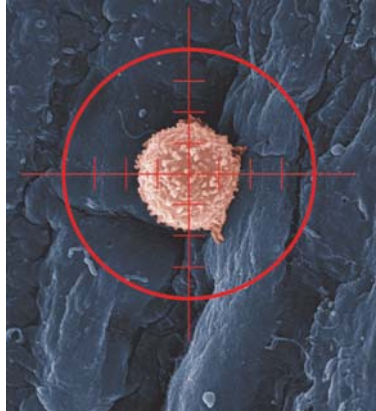
UHN transforms innovative research into technologies, products and drugs that reach people worldwide.

Photo caption (L-R): Drs. Ralph DaCosta and Tak Mak.



Medical Device

MyndMove™ is a therapy marketed by MyndTec Inc., a company co-founded by Dr. Milos Popovic. It helps to recover hand and arm motion in patients suffering from paralysis caused by stroke or spinal cord injury. During rehabilitation, a patient actively attempts a movement (eg, holding a cup) while a trained therapist uses the non-invasive device to stimulate various sets of muscles to create functional movements. This strengthens new neural connections specific to each patient that expedite recovery from paralysis and minimize long-term disability. This year, milestones include: Health Canada medical device licensing approval, a nationwide launch of MyndMove™ and the issuance of its first US patent.



Therapeutic Agent

The research of Drs. John Dick and Jean Wang has revealed new ways to target cancer stem cells. Cancer stem cells are formed when normal stem cells, immature cells found in bone marrow that give rise to all blood cells, develop certain mutations that lead to blood cancers like acute myeloid leukemia. Cancer stem cells are often resistant to conventional therapies. The research findings, licensed to Trillium Therapeutics Inc., will help to develop more effective drugs to target mutations in leukemia. Trillium recently secured \$33 million towards their cancer stem cell program based on this research. These funds will help advance new drug studies, drug manufacturing and Phase I clinical trials.



Quality Assurance

Drs. Mohammad Islam, Robert Heaton and David Jaffray have developed IQM, a device that provides an automated ‘final check’ of machines that deliver radiation therapy (pictured above). These machines require vigilant quality testing because each radiation therapy treatment has an individualized plan due to factors that can change even within the same patient (eg, position). IQM streamlines quality assurance testing to ensure safe and successful delivery of radiation. In turn, this maximizes the time that machines can be used to treat cancer patients (over 50% receive radiation during their treatment). This year, IQM was licensed to iRT, a German start-up company, and was deployed to over 20 clinical testing sites.

Year in Funding

A selection of UHN research funding milestones



Targeting Each Patient's Tumour

On September 10, 2014, a team of researchers led by Drs. Bradly Wouters and Robert Bristow were awarded \$6.6 million over five years from the Terry Fox Foundation. These funds will support research to develop new and more personalized treatments that target the low oxygen levels in tumours—a characteristic that may contribute to a cancer's ability to resist treatment and spread within a person. Other UHN researchers involved in this project include Drs. David Jaffray, Marianne Koritzinsky, Michael Milosevic and Anthony Fyles.

The announcement was made by Dr. Victor Ling (President and Scientific Director, Terry Fox Research Institute) during a special event held at PM Cancer Centre. According to Dr. Ling, a total of \$14.6 million was awarded through the Terry Fox New Frontiers Program to five innovative research projects across Canada—three

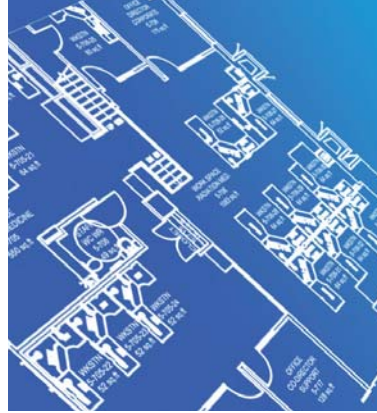
of which were in Ontario. “Each of the Ontario-based projects that we are funding has the potential to revolutionize care for patients with hard-to-treat or advanced cancers through a personalized approach to treatment,” said Dr. Ling.

**Terry Fox Foundation
funding will support
innovative research
programs that will
accelerate the growth and
realization of personalized
medicine treatments.**



Clinical Trials

On September 12, 2014, Brain Canada announced that it will provide \$10 million to fund a Phase III trial (the FRONTIER trial) to evaluate the effectiveness of NA-1, a promising new drug developed by Dr. Michael Tymianski. To test the drug's ability to reduce the damage caused by a stroke, paramedics will administer the drug to 518 stroke patients in Toronto, Peel Region and Vancouver starting in January 2015. "NA-1 is the only emergency treatment that can re-open blocked arteries if given within three to four-and-a-half hours of the onset of stroke symptoms," says Dr. Laurie Morrison, lead researcher on the FRONTIER trial.



Infrastructure

On January 8, 2014, the Canada Foundation for Innovation announced that nine teams led by UHN researchers were awarded \$4.8 million through its John R. Evans Leaders Fund program. This investment, with additional contributions from the private sector, the Ontario Ministry of Research and Innovation, and UHN foundations, will help to develop state-of-the-art facilities to advance research focused on arrhythmias (P. Backx), spinal cord injury (M. Fehlings), cancer (D. Jaffray, H. He, T. Pugh), diabetes and obesity (T. Lam), neurodegenerative diseases (D. Weaver), infectious and neurological diseases (L. Kotra) and vision disorders (V. Wallace).



Researchers

This year, five UHN researchers successfully renewed their Tier 1 Canada Research Chairs, including Drs. Tak Mak (Chair in Inflammation Responses and Traumatic Injury), Linda Penn (Chair in Molecular Oncology), Benjamin Neel (Chair in Signal Transduction and Human Disease), Eleanor Fish (Chair in Women's Health and Immunobiology) and Gordon Keller (Chair in Embryonic Stem Cell Biology). Over the next seven years, these Chairs will provide \$7 million to help support the innovative research programs of these world-leading scientists.

Research News



UHN Ranked Number One

For the fourth year in a row, UHN was listed as Canada's top-funded research hospital on the *Top 40 Research Hospitals in Canada List 2014*, released by RESEARCH Infosource Inc. The list ranks hospitals across Canada by research funding data. During the 2013 fiscal year, UHN reported \$312 million in research expenditures.



caTissueSuite Launch

On December 20, 2013, caTissueSuite was officially launched at UHN. This comprehensive database gives researchers access to information on tissue samples collected and analyzed across UHN's research labs. This includes clinical data (eg, pathology reports) and patient consent information.



New Global Partnership

The PM Cancer Centre signed a Memorandum of Understanding with India's Tata Memorial Centre to create a partnership aimed at advancing innovation and delivery of best practices in cancer care, research and education. The centres will pool their knowledge and expertise, and encourage academic collaboration.



UHN's Vector Facility

The much-anticipated Vector Core Facility was officially launched at the Krembil Discovery Tower this year. This essential resource, which is led by Dr. Jeffrey Medin, will provide researchers with custom-made tools for gene delivery, markers for *in vivo* cell tracking and next-generation tools to optimize cell therapy applications.



Customizing Medicine

Techna hosted its second annual Symposium focused on the topic of personalized cancer medicine (PCM) and its future potential in health care. Experts from across disciplines and sectors discussed the technologies needed to realize PCM and the challenges ahead for research, development and implementation.



Top Cancer Discovery

Dr. Camilla Zimmermann's research, which determined the factors that influence the quality of life of individuals caring for patients with advanced cancer, was selected as one of the top discoveries of 2013 by the Canadian Cancer Society. The study suggested that early palliative care would improve the well-being of caregivers.

Research Distinctions

Selected honours bestowed upon UHN researchers

Dr. David Alter

2013 Heart & Stroke Foundation Ontario Mid-Career Investigator Award

Dr. Nigil Haroon

2013 SAA-Jane Bruckel Young Investigator Award, Spondylitis Association of America (SAA)

Dr. Catherine O'Brien

Early Researcher Award, Ontario Ministry of Research and Innovation

Dr. Phyllis Billia

Clinician Scientist Salary Award (Phase 2), Canadian Institutes of Health Research

2014 Young Investigator Award, Basic Science Category, Canadian Cardiovascular Society

Dr. Brian Hodges

2014 ASME Gold Medal Award, Association for the Study of Medical Education (ASME)

Dr. Lillian Siu

Board of Directors, American Association for Cancer Research

Dr. Marcelo Cypel

Early Researcher Award, Ontario Ministry of Research and Innovation

Dr. Murray Krahn

2013 Dr. Jill M. Sanders Award of Excellence in Health Technology Assessment, Canadian Agency for Drugs and Technologies in Health

Dr. Peter St George-Hyslop

2014 Dan David Prize, Dan David Foundation

Dr. John Dick

Fellow, The Royal Society (UK)

Dr. Douglas Lee

2014 Robert E. Beamish Award, Canadian Cardiovascular Society

Dr. Donna Stewart

Member, Order of Canada

Dr. Michael Fehlings

Fellow, Royal Society of Canada

Dr. Tak Mak

2014 Dr. Chew Wei Memorial Prize in Cancer Research, University of British Columbia

Dr. Ian Tannock

Member, Order of Canada

Dr. Brian Wilson

Fellow, The Optical Society
2014 Britton Chance Biomedical Optics Award, International Society for Optics and Photonics

UHN Foundations

Arthritis Research Foundation

The Princess Margaret Cancer Foundation

Toronto General & Western Hospital Foundation

Toronto Rehab Foundation

UHN Foundations

Arthritis Research Foundation



A Day at the Races On October 6, 2013, the Arthritis Research Foundation proudly held the 14th annual *Day at the Races*, the Foundation's signature fundraising event in support of arthritis and autoimmune disease research. This event has raised over \$1,680,000 for arthritis and related autoimmune disease research.

This year, Honorary Chair Dr. Edward Keystone was recognized for his outstanding research contributions in the areas of rheumatoid arthritis and clinical therapeutics.

Dr. Keystone is committed to overcoming key challenges currently faced by rheumatologists. One of these challenges is the lack of clinical tools that are capable of predicting how individual patients will respond to different medications. This is particularly important because treatments are often administered by trial and error, which can be prohibitively costly and expose patients to harmful side effects. Dr. Keystone's work addresses this issue through exploring ways to better utilize the

existing suite of therapeutic options so that the right treatment is provided at the right time to the right patient.

Dr. Keystone's research program is also focused on the development of new rheumatoid arthritis therapies that more effectively target the disease. His approach takes full advantage of new, cutting-edge technologies, analytical approaches and computing power. This highly collaborative project represents an unprecedented global effort to pinpoint the genes and protein markers that identify early signs of rheumatoid arthritis, predict disease progression and the optimal therapy for individual patients, as well as inform the development of innovative therapies.

The ultimate success of this research will be to translate findings into innovative strategies that prevent disease onset and drive remission.

Photo caption (L-R): Peter Kircher, Sandy Hawley, Helen Ching-Kircher and Dr. Edward Keystone (photo by Jono & Laynie Co.)

The Princess Margaret Cancer Foundation



Billion Dollar Challenge: Getting Closer

On October 15, 2014, The PM Cancer Foundation celebrated the halfway point in its five-year *Billion Dollar Challenge* with an event called ‘A Golden Day’. The campaign aims to help revolutionize cancer care by supporting the creation of a new gold standard of personalized cancer medicine. The funds raised are already facilitating PM Cancer Centre’s largest physical research expansion in its history and its most ambitious recruitment drive.

The halfway celebration of the *Billion Dollar Challenge* was attended by supporters from the Canadian mining industry who donated over \$3.2 million—represented by six gold bars. Ian Telfer, Chairman of the Board of Goldcorp Inc., spoke at the event on behalf of the gold mining industry and the thousands of patients treated at the Centre each year. As a patient benefitting from research into more precise and personalized cancer care, he was pleased to make his own generous donation to support research at the PM Cancer Centre.

The PM Cancer Centre is getting closer to realizing its goal of personalized cancer medicine, thanks to new technology and a better understanding of the individual and complex nature of cancer. The IMPACT and COMPACT studies are excellent examples of how the Centre is re-tooling and preparing for a more personalized approach to cancer diagnostics. These studies have already sequenced the DNA of over 2,000 tumours and used this information to direct patients to clinical studies of drugs targeted to their specific type of cancer.

The *Billion Dollar Challenge* is a partnership between the Foundation and researchers at PM Cancer Centre. At the beginning of the campaign, each group was challenged to raise \$500 million over five years. At the halfway point, the groups have raised \$576 million.

Photo caption: Canadian gold mining industry leaders (left image) Ian Telfer with RCMP Officers and (right image; L-R) Sean Boyd, President and CEO of Agnico Eagle Mines Limited, with Ian Telfer (photo by Michael Tenaglia).

Toronto General & Western Hospital Foundation



A New Home for Discovery Over seven years of planning, fundraising and construction culminated in the celebration of the official opening of the Krembil Discovery Tower on November 20, 2013. At the heart of the celebration was a tribute to the generosity of the Krembil Family.

“Researchers will tell you they don’t lack ideas or pathways to pursue in their labs—they lack only the human and physical resources to do so. That’s what we told Bob and Linda Krembil and family,” said Tennyson Hanson, President and CEO of Toronto General & Western Hospital Foundation. The Krembil Family listened and stepped forward with a \$30 million lead gift for the building, which was matched with an additional \$30 million in private funding. With \$60 million in donations secured, UHN was able to attract \$29 million in support from the Canada Foundation for Innovation for the Tower.

“The Krembil Discovery Tower is now a reality thanks to the fundraising efforts of

our generous donor community who were inspired by the Krembil family’s leadership,” said John Mulvihill, Chair of the UHN Board of Trustees. He also acknowledged Robert Krembil’s volunteer services as a UHN Trustee and son Mark Krembil’s involvement as a Toronto General & Western Hospital Foundation Board Member.

At the celebration, Robert Krembil explained why it was so important to his family to support TWRI. “We have been involved with neuroscience at TWH for several years and have observed the evolving breadth and depth of talent. Our team of scientists and clinicians is exceptionally impressive on many dimensions in comparison to other neuroscience centres around the world. Now we have a facility that is appropriate for such a renowned group.”

Photo caption (L-R): Jacob Krembil, John Mulvihill, Stacey Krembil, Nancy Mulvihill, Linda Krembil, Mark Krembil, Dr. Gerry Halbert, Tootsie Halbert and Robert Krembil (photo by John Loper).

Toronto Rehab Foundation



New Outpatient Centre Opens its Doors

Toronto Rehab's Fred A. Litwin Outpatient Centre is a one-stop destination for patients and families, housing a number of essential services under one roof. The multimillion dollar donation from Fred A. Litwin and the Litwin family is enabling pioneering research and more efficient service for thousands of patients each year.

"Toronto Rehab is a jewel in the health care landscape," says Fred Litwin, Chief Executive Officer and President of Forum Financial Corporation. "The hospital cares for individuals as they regain their independence and recapture their potential. What could be more rewarding than helping people return to their families, their communities and their lives? I am so proud of my family's association with this great hospital."

Through the Fred A. Litwin Outpatient Centre, patients can access the latest therapies being developed by researchers at Toronto Rehab. For example, patients with paralysis

resulting from spinal cord injury and stroke can now have their limb function restored through Functional Electric Stimulation (FES)—a therapy that uses electricity to push muscles into action and retrain the central nervous system. MyndMove™, a device created by Dr. Milos Popovic, has produced unprecedented levels of recovery and is the first therapy to produce significant increases in upper arm mobility in patients.

The Litwin family's transformative gift is enabling world-leading advances that will impact the future of health care. "On May 29, 2014, Toronto Rehab celebrated the establishment and the dedication of the Fred A. Litwin Outpatient Centre," says Cindy Yelle, President and CEO of Toronto Rehab Foundation. "It was an important moment that will undoubtedly go down in the history of this great organization."

Photo caption: Fred and Mary Litwin pictured in Toronto Rehab's Fred A. Litwin Outpatient Centre (photo by William Suarez).

UHN Research Institutes

Princess Margaret Cancer Centre

Techna Institute

Toronto General Research Institute

Toronto Rehabilitation Institute

Toronto Western Research Institute

Princess Margaret Cancer Centre

Research Space	390,672 sq. ft.
External Funding	\$150,154,247
Publications	1,224
Senior Scientists	45
Scientists	17
Affiliate Scientists	14
Assistant Scientists	3
CCRU	297
Total Researchers	376
Fellows	286
Graduate Students	242
Total Trainees	528
Total Staff	780

Research Council on Oncology (RCO)

Director, PM Cancer Centre; Chair, RCO; Director, Executive Committee Benjamin Neel

Executive Committee Mitsuhiro Ikura, Rama Khokha, Senthil Muthuswamy, Pamela Ohashi, Gary Rodin, Ming-Sound Tsao, Brian Wilson, Bradly Wouters

Chair, Appointments Committee Rama Khokha

Medical Director, Laboratory Medicine Program Sylvia Asa

Medical Director, Cancer Program Mary Gospodarowicz

Head, Radiation Medicine Fei-Fei Liu

Head, Medical Oncology and Hematology Malcolm Moore

Head, CCRU Amit Oza

Chief, Surgical Oncology Jonathan Irish

Executive Director, Research Operations Lisa Alcia

Senior Vice President, UHN and Executive Lead, PM Cancer Centre Marnie Escaf

Vice President, Research Christopher Paige

Researchers

Senior Scientists

Kenneth Aldape

Cheryl Arrowsmith

Sylvia Asa

Norman Boyd

Robert Bristow

Avijit Chakrabartty

Gerald Devins

John Dick

Shereen Ezzat

Lucia Gagliese

Razqallah Hakem

David Hedley

Richard Hill

Doris Howell

Mitsuhiro Ikura

Norman Iscove

David Jaffray

Igor Jurisica

Gordon Keller

Rama Khokha

Thomas Kislinger

Lothar Lilje

Fei-Fei Liu

Geoffrey Liu

Tak Mak

Jeffrey Medin

Mark Minden

Senthil Muthuswamy

Benjamin Neel

Pamela Ohashi

Emil Pai

Christopher Paige

Linda Penn

Gilbert Privé

Brian Raught

Gary Rodin

Robert Rottapel

Aaron Schimmer

Vuk Stambolic

James Till

Ming-Sound Tsao

I Alex Vitkin

Brian Wilson

Bradly Wouters

Gang Zheng

Scientists

Laurie Ailles

Scott Bratman

Ralph DaCosta

Daniel De Carvalho

Kim Edelstein

Benjamin Haibe-Kains

Housheng Hansen He

Naoto Hirano

Michael Hoffman

Mathieu Lupien

Nadeem Moghal

Catherine O'Brien

Trevor Pugh

Michael Roehrl
Rodger Tiedemann
Gelareh Zadeh
Camilla Zimmermann

Assistant Scientists

Toshiyuki Araki
Zhenyue Hao
Lakshmi Muthuswamy

Affiliate Scientists

Eric Xueyu Chen
Mary Jane Espen
Anthony Joshua
C Anne Koch
Malcolm Moore
Michael Moran
Michael Reedijk
Paul Ritvo
Leonardo Salmena
Michael Sherar
Suzanne Trudel
Jean Wang
Julia Wang
Wei Xu

**Cancer Clinical Research Unit
(CCRU)**

Ayman Al Habeeb
Hamideh Alasti
Eitan Amir
Mostafa Atri
Wing Au
Michael Baker
Linda Balneaves
Subrata Banerjee
David Barth
Eric Bartlett
Andrew Bayley
Philippe Bedard
J Robert Beecroft
Akbar Beiki-Ardakani
Robert Bell
Hal Berman
Marcus Bernardini
Lori Bernstein
Mark Bernstein
Andrea Bezjak
Jean-Pierre Bissonnette
Martin Blackstein
Ivan Blasutig
Robert Bleakney
Scott Boerner
Jette Borg
Anthony Brade
Donald Branch
Stephen Breen

William Brien
James Brierley
Dale Brown
John Bryson
Karina Bukhanov
Ronald Burkes
Marcus Butler
Marco Carlone
Charles Catton
Pamela Catton
David Cescon
Hong Chang
Tanya Chawla
Christine Chen
Douglas Chepeha
Runjan Chetty
Carol Cheung
Frederick Cheung
John Cho
Charles Cho
Young-bin Cho
James Chow
Caroline Chung
Peter Chung
Tulin Cil
Blaise Clarke
Sean Cleary
Tatiana Conrad
Catherine Coolens
Timothy Craig
Adrian Crawley
Andrew Crean
R Michael Crump
Pavel Crystal
Christine Cserti
Bernard Cummings
Marcelo Cypel
Norma D'Agostino
Andrei Damyanovich
Gail Darling
Laura Dawson
John de Almeida
Marc de Perrot
Jan Delabie
Neesha Dhani
Eleftherios Diamandis
Robert Dinniwel
Jason Dodge
Susan Done
James Downar
Alexandra Easson
Saibishkumar Elantholi
Parameswaran
Mary Elliott

Christine Elser
Jaime Escallon
Andrew Evans
Ronald Feld
Louis Fenkell
Peter Ferguson
Sarah Ferguson
Antonio Finelli
Peter Fitzgerald
Rachel Fleming
Neil Fleshner
Jeremy Freeman
Anthony Fyles
Steven Gallinger
William Geddie
Frederick Gentili
Sandeep Ghai
Sangeet Ghai
Danny Ghazarian
Ralph Gilbert
Meredith Giuliani
Rebecca Gladdy
David Goldstein
Pamela Goodwin
Mary Gospodarowicz
David Grant
David Green
Paul Greig
Robert Gryfe
Patrick Gullane
Abha Gupta
Vikas Gupta
Sarah Hafezi-Bakhtiari
Masoom Haider
Sarah Hales
Robert Hamilton
Kathy Han
Anthony Hanbidge
Breffni Hannon
Robert Heaton
Mostafa Heydarian
Chia-Sing Ho
David Hodgson
Stefan Hofer
David Hogg
Andrew Hope
David Hwang
Elizabeth Hyjek
Jonathan Irish
Mohammad Islam
Nassir Jaffer
Hyun-Jung Jang
Raymond Jang
Jeff Jaskolka

PM Cancer Centre

Michael Jewett
Kartik Jhaveri
John Jezioranski
Jennifer Jones
John Kachura
Tuula Kalliomäki
Suzanne Kamel-Reid
Zahra Kassam
Edward Kassel
Ebru Kaya
Armand Keating
Harald Keller
Erin Kennedy
Shaf Keshavjee
Korosh Khalili
Tim-Rasmus Kiehl
Dong Hwan Kim
John Kim
Tae Kyoung Kim
Jennifer Knox
Hyang-Mi Ko
Paul Kongkham
Hatem Krema
Timo Krings
Monika Krzyzanowska
Walter Kucharczyk
Vishal Kukreti
Vathany Kulasingam
Girish Kulkarni
Supriya Kulkarni
Kevin Kuo
John Kuruvilla
Stéphane Laframboise
Normand Laperriere
Natasha Leighl
Wey-Liang Leong
Daniel Létourneau
Wilfred Levin
Madeline Li
Winnie Li
Patricia Lindsay
Jeffrey Lipton
Christopher Lo
Helen Mackay
Miller Macpherson
Ernie Mak
Lee Manchul
Myles Margolis
Warren Mason
Andrew Matthew
J Andrea McCart
David McCready
Ian McGilvray
Robin McLeod

Andrea McNiven
Tatiana Melnyk
Cynthia Ménard
Ravi Menezes
Ozgun Mete
Ur Metser
Howard Michaels
David Mikulis
Barbara-Ann Millar
Kim Miller
Naomi Miller
Michael Milosevic
Chantal Morel
Lyndon Morley
Douglas Moseley
Carol-anne Moulton
Anna Marie Mulligan
K Joan Murphy
Kieran Murphy
Rumina Musani
Elsie Nguyen
Rinat Nissim
Nancy Olivieri
Martin O'Malley
Anne O'Neill
Brian O'Sullivan
Amit Oza
Sophia Pantazi
Narinder Paul
Jacob Pendergrast
Bayardo Perez-Ordonez
Andrew Pierre
Anna Porwit
Anca Prica
Thomas Purdie
Fayez Quereshy
Dheeraj Rajan
Albiruni Razak
Donna Reece
Julia Ridley
G Jolie Ringash
Alexandra Rink
Heidi Roberts
Graham Roche-Nagle
Patrik Rogalla
Barry Rosen
Lorne Rotstein
Marjan Rouzbahman
Gilda Santos
Anabel Scaranelo
Andre Schuh
Matthew Seftel
Stefano Serra
Michael Sharpe

Patricia Shaw
Frances Shepherd
Manohar Shroff
E Rand Simpson
Lillian Siu
Roger Smith
Boraiah Sreeharsha
Srikala Sridhar
Teodor Stanescu
Alexander Sun
D Robert Sutherland
Carol Swallow
Joan Sweet
Jeff Tanguay
Mojgan Taremi
Bryce Taylor
Karel terBrugge
Seng Thipphavong
Paaladinesh Thavendiranathan
Santhosh Thyagu
Anne Tierens
Ants Toi
Emina Torlakovic
John Trachtenberg
Richard Tsang
Theodore van der Kwast
Monique van Prooijen
Thomas Waddell
John Waldron
Richard Ward
Padraig Warde
David Warr
Alice Wei
Ilan Weinreb
Woodrow Wells
Xiao-Yan Wen
Kirsten Wentlandt
Lawrence White
Daniel Winer
Bernd Wintersperger
Ian Witterick
Rebecca Wong
Robert Wood
Jay Wunder
Kazuhiro Yasufuku
Karen Yee
Erik Yeo
Ivan Yeung
Bruce Youngson
Eugene Yu
Beibei Zhang
Toni Zhong
Alexandre Zlotta

Techna Institute

Research Space	9,730 sq. ft.
External Funding	\$2,366,677
Publications	249
Core Leads	8
Faculty	3
Affiliated Faculty	39
Total Researchers	50
Fellows	11
Graduate Students	55
Total Trainees	66
Total Staff	32

Techna Leadership Team

Director, Techna Institute David Jaffray
Director, Clinical Faculty Kieran Murphy
Director, Commercialization Mark Taylor
Director, Operations & Engineering Luke Brzozowski
Director, Clinical Processes Howard Abrams
Director, Research Faculty Paul Santerre
Director, Communication & Knowledge Transfer Gunther Eysenbach
Vice President, Research Christopher Paige

Researchers

Design & Engineering for Health

Core Lead

Joseph Cafazzo

Affiliated Faculty

James Drake

Anthony Easty

Emily Seto

Patricia Trbovich

Leonard Tse

Guided Therapeutics

Core Leads

Jonathan Irish

David Jaffray

Faculty

Margarete Akens

Ralph DaCosta

Arash Zarrine-Afsar

Affiliated Faculty

Dionne Aleman

Jean-Pierre Bissonnette

Timothy Chan

Catherine Coolens

John De Almeida

James Drake

Gabor Fichtinger

Justin Grant

Mojgan Hodaie

Andrew Hope

Mohammad Islam

Daniel Létourneau

Andres Lozano

Claire McCann

Cynthia Ménard

Narinder Paul

Thomas Purdie

Dheeraj Rajan

Alexandra Rink

Michael Sharpe

Michael Sherar

Teodor Stanescu

I Alex Vitkin

Robert Weersink

Bernd Wintersperger

Kazuhiro Yasufuku

Informatics & Communications Technology

Core Leads

Igor Jurisica

Peter Rossos

Affiliated Faculty

Brenda Gallie

Alejandro Jadad

Michael Jewett

Gordon Tait

Christian Veillette

Nanotechnology & Radiochemistry

Core Leads

Ur Metser

Gang Zheng

Affiliated Faculty

Christine Allen

Shyh-Dar Li

John Valliant

Photonics

Core Lead

Brian Wilson

Toronto General Research Institute

Research Space	238,189 sq. ft.
External Funding	\$73,803,562
Publications	1,048
Senior Scientists	58
Scientists	26
Affiliate Scientists	49
Assistant Scientists	2
Clinical Researchers	121
Total Researchers	256
Fellows	225
Graduate Students	165
Total Trainees	390
Total Staff	464

Research Council

Director, TGRI; Chair, TGRI Research Council; Division Head (Acting), Experimental Therapeutics Mansoor Husain
Division Head, Advanced Diagnostics Myron Cybulsky
Division Head, Support, Systems & Outcomes David Urbach
Program Medical Director, Peter Munk Cardiac Centre Barry Rubin
Program Medical Director, Transplantation Atul Humar
Surgeon-in-Chief; Program Medical Director, Surgical & Critical Care Shaf Keshavjee
Physician-in-Chief; Program Medical Director, Medical & Community Care Edward Cole
Chair, TGRI Appointments Committee Thomas Waddell
Group Lead, Cardiovascular Douglas Lee
Group Lead, Metabolism Michael Wheeler
Group Lead, Infection & Immunity TBD
Group Lead, Respiratory & Critical Care Mingyao Liu
Group Lead, Communities of Health Shabbir Alibhai
Executive Director, Research Operations Lisa Alcia
Senior Vice President, UHN and Executive Lead, TGH Scott McIntaggart
Vice President, Research Christopher Paige

Researchers

Advanced Diagnostics

Senior Scientists

Johane Allard
 Peter Backx
 Stuart Berger
 Daniel Cattran
 Myron Cybulsky
 I George Fantus
 Eleanor Fish
 Joseph Fisher
 John Floras
 Reginald Gorczynski
 Avrum Gotlieb
 Tony Lam
 Gary Lewis
 Mingyao Liu
 Peter Liu

Kelly MacDonald
 Kumaraswamy
 Nanthakumar
 York Pei
 Barry Rubin
 Katherine Siminovitch
 Michael Wheeler
 Eldad Zacksenhaus
 Li Zhang
Scientists
 Filio (Phyllis) Billia
 David Cherney
 Shannon Dunn
 Jason Fish
 Anthony Gramolini
 Tianru Jin
 Bruce Perkins

Heather Reich
 Clinton Robbins
 Jonathan Rocheleau
 Daniel Winer
 Minna Woo
Affiliate Scientists
 Donald Branch
 Hong Chang
 David Clark
 Jeffrey Medin
 Anna Sawka
 Florence Wong

Experimental Therapeutics
Senior Scientists
 T Douglas Bradley

Mark Cattral
 Marc de Perrot
 Niall Ferguson
 Atul Humar
 Mansoor Husain
 Harry Janssen
 Kevin Kain
 Armand Keating
 David Kelvin
 Shaf Keshavjee
 Walter Kucharczyk
 Gary Levy
 Ren-Ke Li
 Nancy Olivieri
 Vivek Rao
 Thomas Waddell
 Sharon Walmsley

Richard Weisel
Scientists
 Vijay Chauhan
 Marcelo Cypel
 Jordan Feld
 M Margaret Herridge
 Keyvan Karkouti
 Rupert Kaul
 Lakshmi Kotra
 J Andrea McCart
 Ian McGilvray
 M Cristina Nostro
Affiliate Scientists
 Marissa Battistella
 Denise Belsham
 Limin Chen
 Chung-Wai Chow
 Gregory Downey
 Stephen Fremes
 Anand Ghanekar
 David Grant
 Raymond Hui
 Shahid Husain
 David Hwang
 Joel Katz
 Thomas Lindsay
 Cheri McGowan
 Milica Radisic
 Raymond Reilly
 Sheila Riaz
 Heather Ross
 Coleman Rotstein
 Masaaki Sato
 Michael Sefton
 Markus Selzner
 Darrell Tan
 Kazuhiro Yasufuku
 Terrence Yau
Assistant Scientists
 Lena Serghides
 Sara Nunes de
 Vasconcelos

Support, Systems & Outcomes

Senior Scientists
 Shabbir Alibhai
 Anne Bassett
 Claire Bombardier
 Angela Cheung
 Abdallah Daar
 Anthony Easty
 Gunther Eysenbach
 Alastair Flint

Allan Kaplan
 Moira Kapral
 Murray Krahn
 Charmaine Lok
 Gary Rodin
 Peter Singer
 Donna Stewart
 David Urbach
Scientists
 Anna Gagliardi
 Douglas Lee
 Robert Nolan
 Janet Raboud
Affiliate Scientists
 Patricia Colton
 Caroline Davis
 Gina Dimitropoulos
 Alan Fung
 Sherry Grace
 Enza Gucciardi
 Brian Hodges
 M Jane Irvine
 Jennifer Jones
 Adrienne Kovacs
 Gail McVey
 I Gary Naglie
 Kathryn Nichol
 Marion Olmsted
 Rima Styra
 George Tomlinson
 Alice Wei
 D Blake Woodside

Clinical Researchers

Susan Abbey
 Howard Abrams
 Mostafa Atri
 Carmen Avila-Casado
 Michael Baker
 Joanne Bargman
 W Scott Beattie
 Ivan Blasutig
 Isaac Bogoch
 Vera Brill
 Ryan Brydges
 Joseph Cafazzo
 Douglas Cameron
 Charles Chan
 Christopher Chan
 Anil Chopra
 Hance Clarke
 Sean Clarke
 Edward Cole
 Richard Cooper

Robert Cusimano
 Paul Daly
 Tirone David
 Diego Delgado
 Eleftherios Diamandis
 George Djaiani
 Adam Dubrowski
 Vladimir Dzavik
 Eddy Fan
 Michael Farkouh
 Ludwik Fedorko
 Christopher Feindel
 Scott Fung
 Sandra Grgas
 Michael Gardam
 Susan George
 Sangeet Ghai
 Shiphra Ginsburg
 John Granton
 Sophie Grigoriadis
 Flavio Habal
 Michelle Hladunewich
 Eric Horlick
 Susy Hota
 Cheryl Jaigobin
 S Vanita Jassal
 Angela Jerath
 Michael Jewett
 Rohan John
 K Wayne Johnston
 Jacek Karski
 Hans Katzberg
 Sidney Kennedy
 Edward Keystone
 S Joseph Kim
 Tae Kyoung Kim
 Simon Kitto
 Deepali Kumar
 Ayelet Kuper
 Megan Landes
 Leslie Lilly
 Christine Maheu
 Stuart McCluskey
 Traci McFarlane
 Massimiliano Meineri
 Judith Miller
 Leonid Minkovich
 Chantal Morel
 Carol-anne Moulton
 Emily Musing
 Gary Newton
 Gerald O'Leary
 Mark Osten

Christopher Overgaard
 Maral Ouzounian
 Carolyn Plummer
 Heather Pollex
 Dheeraj Rajan
 Harry Rakowski
 Anthony Ralph-Edwards
 Eberhard Renner
 Robert Richardson
 Charlotte Ringsted
 Heidi Roberts
 Graham Roche-Nagle
 John Ross
 Peter Rossos
 John Rutka
 Irving Salit
 James Scholey
 Leonard Schwartz
 Nazia Selzner-Malekkiani
 Shane Shapera
 Morris Sherman
 Candice Silversides
 Lianne Singer
 Samir Sinha
 Smit Sinha
 Anna Skorzevska
 Peter Slinger
 Miranda So
 Sanjeev Sockalingam
 Michael Sole
 Marshall Sussman
 Kong Teng Tan
 Paaladinesh Thavendiranathan
 Kathryn Tinckam
 Wendy Tsang
 Leonard Tse
 Alice Tseng
 Annette Vegas
 Rachel Maya Wald
 Marcin Wasowicz
 Duminda Wijesundera
 Stephen Wolman
 Pui-Yuen Wong
 Rene Wong
 Nicole Woods
 Douglas Wooster
 Robert Wu
 Paul Yip

Toronto Rehabilitation Institute

Research Space	64,515 sq. ft.
External Funding	\$8,650,762
Publications	389
Senior Scientists	18
Scientists	22
Affiliate Scientists	78
Total Researchers	118
Fellows	55
Graduate Students	177
Total Trainees	232
Total Staff	127

Research Advisory Committee (RAC)

Director, TRI; Chair, RAC Geoff Fernie

Team Leaders T Douglas Bradley, Tilak Dutta, Robin Green, Avril Mansfield, Katherine McGilton, Alex Mihailidis, Paul Oh, Milos Popovic, Yana Yunusova

Sub-Committee Chairs Katherine McGilton, Catriona Steele

Business Development Catharine Hancharek, Gavin Ouyang, Promise Xu

Research Operations Kamal Garcha, Alex Karabanow, Bridgette Murphy, Lois Ward, Amy Xi Chen, Katherine Zeman

Trainee Representatives Alexandra Arnold-Oatley, Gabriela Melo Ghisi, Jennifer Tomaszczyk

Clinical Liaison Mark Bayley

Liaisons Susan Rappolt, Elizabeth Rochon

Senior Vice President, UHN and Executive Lead, TR Susan Jewell

Vice President, Research Christopher Paige

Researchers

Artificial Intelligence & Robotics

Senior Scientist

Alex Mihailidis

Scientists

Frank Rudzicz

Babak Taati

Affiliate Scientists

Sven Dickinson

David Fleet

Deborah Hébert

Jesse Hoey

Dana Kulić

James Little

Alan Mackworth

Goldie Nejat

Pascal Poupart

Rosemary Ricciardelli

Rosalie Wang

Cardiorespiratory Fitness

Senior Scientists

David Alter

Sherry Grace

Scientists

Tracey Colella

Paul Oh

Affiliate Scientists

Krista Lanctôt

Cognition

Senior Scientists

Angela Colantonio

Robin Green

Scientists

Mark Bayley

Nora Cullen

Affiliate Scientists

Nicole Anderson

Deirdre Dawson

Michelle Keightley

Brian Levine

Doug Richards

Jennifer Steeves

Communication

Senior Scientist

Elizabeth Rochon

Scientist

Frank Rudzicz

Affiliate Scientists

Sonya Allin

Melanie Baljko

Boaz Ben-David

Craig Chambers

Tom Chau

Petros Faloutsos

Karen Gordon

Julie Mendelson

Aravind Namasivayam

M Kathleen Pichora-Fuller

Frank Russo

Alexander Shaw
Fraser Shein
Gurjit Singh
Pascal van Lieshout
Yana Yunusova

Mobility

Senior Scientists

Dina Brooks
Brian Maki
William McIlroy

Scientists

William Gage
Avril Mansfield
Kara Patterson
Affiliate Scientists
Alastair Flint
Mary Fox
Andrea Iaboni
Andrew Laing
Sunita Mathur
Laura Middleton
George Mochizuki
Stephen Perry
James Pratt
Karl Zabjek

Neural Engineering & Therapeutics

Senior Scientist

Milos Popovic
Scientists
B Catharine Craven
César Márquez-Chin
Kei Masani
Kristin Musselman
Frank Rudzicz
Jose Zariffa

Affiliate Scientists

Sandra Black
Julio Furlan
Lora Giangregorio
Pamela Houghton
Mary Nagai
Ethne Nussbaum
Linda Rapson
Ze'ev Seltzer
John Shepherd
Molly Verrier
Timothy Welsh
Paul Yoo

Optimize

Senior Scientists

Cheryl Cott
Sherry Grace
Susan Jaglal
Pia Kontos
Katherine McGilton
I Gary Naglie
Susan Rappolt

Scientists

Shabbir Alibhai
Andrea Furlan
Walter Wodchis
Affiliate Scientists
G Ross Baker
Veronique Boscart
Jill Cameron
Mary Fox
Michel Landry
Nizar Mahomed
Denise Reid
Nancy Salbach
Kathryn Sibley

Sleep & Upper Airway

Senior Scientists

T Douglas Bradley
Catriona Steele

Scientists

Hisham Alshaer
Frank Rudzicz
Azadeh Yadollahi
Affiliate Scientists
Liza Duizer
Jack Goodman
David James
Heather Keller
Sonja Molfenter
Brian Murray
Clodagh Ryan
Scott Thomas

Technology

Senior Scientist

Geoff Fernie
Scientists
Jennifer Campos
Tilak Dutta
Andrea Furlan
Bruce Haycock
César Márquez-Chin
Christine Novak
Azadeh Yadollahi

Affiliate Scientists

Veronique Boscart
Karen Gordon
Dinesh Kumbhare
Matthew Muller
Hani Naguib
Donald Philip
Veronica Wadey

Toronto Western Research Institute

Research Space	155,246 sq. ft.
External Funding	\$36,606,009
Publications	667
Senior Scientists	37
Scientists	11
Affiliate Scientists	20
Clinical Researchers	93
Total Researchers	161
Fellows	98
Graduate Students	128
Total Trainees	226
Total Staff	225

Research Council

Director and Chair, TWRI Research Council Donald Weaver
Division Head, Brain, Imaging & Behaviour – Systems Neuroscience Karen Davis
Division Head, Fundamental Neurobiology Peter Carlen
Division Head, Genetics & Development James Eubanks
Division Head, Health Care & Outcomes Research Elizabeth Badley
Division Head, Patient-based Clinical Research TBD
Division Head, Vision Science Valerie Wallace
Interim Clinical Representative, Krembil Neuroscience Program Vera Brill
Clinical Representative, Musculoskeletal Health & Arthritis Program Robert Inman
Clinical Representative, Musculoskeletal Program Nizar Mahomed
Chair, Trainee Affairs Committee Frances Skinner
Executive Director, Research Operations Lisa Alcia
Senior Vice President, UHN and Executive Lead, TWH Katherine Sabo
Vice President, Research Christopher Paige

Researchers

Brain, Imaging & Behaviour - Systems Neuroscience

Senior Scientists
 Jonathan Brotchie
 Robert Chen
 Karen Davis
 William Hutchison
 Andres Lozano
 Mary Pat McAndrews
 David Mikulis
 Paul Sandor
 Antonio Strafella
Scientists
 Jonathan Downar
 Mojgan Hodaie
Affiliate Scientists
 Luc De Nil
 Nicholas Diamant
 Jonathan Dostrovsky

Walter Kucharczyk

Fundamental Neurobiology

Senior Scientists
 Peter Carlen
 Frances Skinner
 Shuzo Sugita
 Michael Tymianski
 Donald Weaver
Scientist
 Ivan Radovanovic
Affiliate Scientists
 Herbert Gaisano
 Magdy Hassouna
 Taufik Valiante
 Liang Zhang
 Georg Zoidl

Genetics & Development

Senior Scientists
 Cathy Barr
 James Eubanks
 Michael Fehlings
 Robert Inman
 Philippe Monnier
 Lyanne Schlichter
 Elise Stanley
 Charles Tator
 Florence Tsui
 Joan Wither
Scientists
 W Mark Erwin
 Lorraine Kalia
 Suneil Kalia
 Mohit Kapoor
Affiliate Scientist
 Nigil Haroon

**Health Care & Outcomes
Research**

Senior Scientists

Elizabeth Badley
J David Cassidy
Aileen Davis
Dafna Gladman
Nizar Mahomed
Murray Urowitz

Affiliate Scientists

Cheryl Cott
Paul Fortin
Monique Gignac
Rosemary Martino

Patient-based Clinical Research

Senior Scientists

Anthony Lang
Colin Shapiro

Scientists

Mark Bernstein
Susan Tarlo

Vector Core

Senior Scientist

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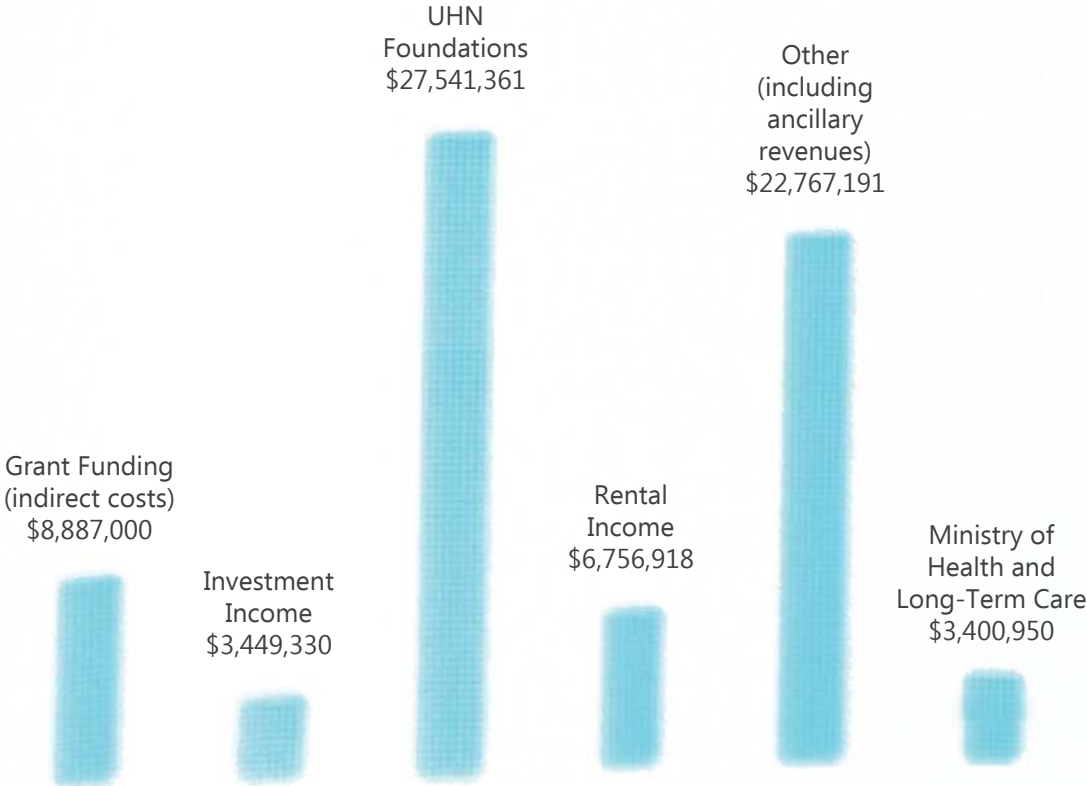
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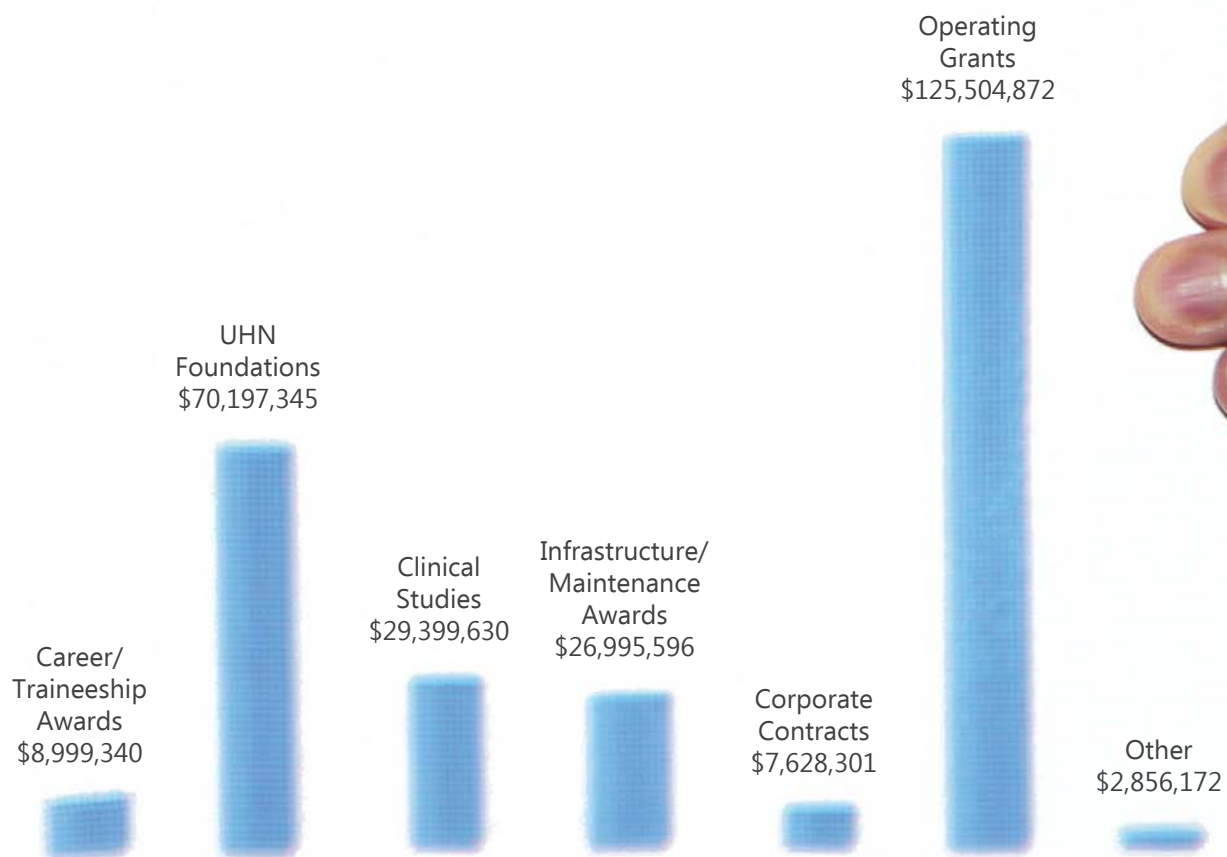
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