Better Performance
Faster Treatment Planning
Stronger Immune System

BETTER. FASTER. STRONGER.

Better Therapies
Faster Diagnosis
Stronger Hearts

2017 Research Report
Health innovation at UHN
UHN Research Snapshot

TOTAL RESEARCHERS 1,094
Appointed Researchers 464
Clinical Researchers 630

RESEARCH SPACE 969,913 sq. ft.

TOTAL FUNDING $386,192,252

TOTAL TRAINEES 783
Fellows 309
Graduate Students 474

TOTAL STAFF 2,098
Institute Staff 1,802
Research Support Staff 296

PUBLICATIONS 3,732

The cover features six UHN researchers whose work exemplifies how we are making health care better, faster and stronger. They are, from top left (clockwise): Drs. Karen Davis, Thomas Purdie, Pamela Ohashi, Michael Laflamme, Frank Rudzicz and Cristina Nostro.

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

Featured Research

Why Some Gain When Under Pain
More flexible communication in the brain could make pain less of a distraction while performing a task

Making Every Move Count
Research exposes a hidden defence mechanism that protects cancer from the body’s immune system

Reading Between the Lines
New artificial intelligence platform can diagnose and monitor Alzheimer disease using verbal descriptions of an image

On Target for Cell Therapy
New method could lead to safer stem cell-derived diabetes treatments

Artificial Intelligence Feeds Need for Speed
Technology is being used to fast-track radiation therapy plans and conserve clinical resources

From Building Blocks to BlueRock
BlueRock Therapeutics receives historic investment to advance stem cell research

Support: New funding spurs world-class innovation

Discovery: A selection of top research findings

Impact: How research at UHN is improving health care

UHN Foundations

Research Distinctions
Research Institutes
Research Committees
External Sponsors
Financials
Research Trustee and Advisory Boards
Welcome Message

Pushing the Limits

High-performance athletes train for years to become the best in their field. They consistently push themselves beyond what they are capable of, honing their skills through an unwavering drive. And once they’ve attained their goal—it breaking a personal best, winning a gold medal or shattering a world record—it’s on to the next challenge.

The same can be said of our researchers.

Our researchers tirelessly work to better understand disease, improve the delivery of care, and the effectiveness and efficiency of the health care system. Along with clinicians, health care professionals, funders and patients, they make a united front to define the most important unmet needs. And together they work to address these needs while setting and achieving goals that are far beyond what would be possible as individuals.

Some of our researchers set their sights on creating a better understanding of disease as a path towards improved health. Examples include those who reveal new molecular targets that lead to the development of better, more specific therapeutic drugs; those who identify gaps in care that inform new, more effective clinical tools and policies; and those who find better ways to bring basic research findings to the clinic to help patients. This knowledge can be translated into a better approach to doing something, whether it’s a research method, therapeutic strategy or way of performing surgery. These solutions continually enhance and refine the delivery of health care.

Emerging technologies have enabled other researchers to improve care at an increasingly faster pace. These technologies include advanced DNA sequencing approaches that reveal the complexities of the human genome with unprecedented speed. Our researchers are also developing machine learning methods to reduce the time it takes to plan treatments, so that patients get the care they need sooner. Both examples demonstrate how our researchers are using these technologies to their fullest potential to accelerate the application of research, the delivery of quality care and to ease the burden on the health care system by reducing wait times.

Others still are building stronger systems. Our researchers are experts in regenerative approaches to repair damaged organs, and leaders in developing rehabilitation programs to strengthen patients’ minds and bodies as they age or recover from life-threatening situations. Some are translating their work by commercializing new products or founding new companies through history-making investments from private sector partners; these deliverables fortify the bioeconomy and reinforce the profile of Toronto’s research ecosystem on the world stage. Regardless of the means, those engaged in these activities strive to build robust systems—from cells, tissues and organs to networks, consortia and companies—towards enriching human health and wellbeing.

We hope you will enjoy the examples we selected in this year’s report to highlight how our researchers are helping to make health care better, faster and stronger.
Why Some Gain When Under Pain

More flexible communication in the brain could make pain less of a distraction while performing a task

Despite being hampered by painful injuries, many athletes continue to compete and win. For example, Toronto Maple Leafs defenceman Bobby Baun played several playoff games with a broken ankle and helped his team win the Stanley Cup in 1964.

Why is it that some individuals can perform a task—and do it well—while experiencing pain?

“There is a complex relationship between pain and attention, where pain can modulate attention and vice versa. Moreover, the interplay between these two factors differs from one person to the next,” explains Dr. Karen Davis.

Dr. Davis has shown that individuals can be classified as one of two types depending on how pain affects their performance in doing a task. In P-type individuals, pain impedes their ability to perform a task; whereas, in A-type individuals, like Bobby Baun, pain enhances their performance.

To gain a better understanding of the brain mechanisms that contribute to this divergent behaviour during pain, Dr. Davis and her PhD student Joshua Cheng led a study examining patterns of brain activity in these two groups.

First, 51 healthy participants were classified as either A-type or P-type based on their performance in a complex mental task in the presence and absence of a painful stimulus. Next, the participants underwent a functional MRI (fMRI) scan, while they were not thinking of anything in particular, to measure their spontaneous brain activity.

The researchers focused their study on the activity of brain cells in two networks: the executive control (EC) network and the salience network. The EC network helps to optimize a person’s behaviour in response to what’s happening around them; whereas, the salience network is normally engaged when something like pain draws your attention.

Through their analysis, Dr. Davis and her research team discovered a link between spontaneous brain activity and task performance with pain. The synchrony of activity between the EC network and the salience network, as well as within the salience network, was more flexible in A-type individuals than P-type individuals. These findings suggest that brain communication is more flexible in A-type individuals—a feature that could be important for prioritizing task performance over pain, producing better performance.

Regarding her future work, Dr. Davis says, “We’d like to explore whether communication flexibility is disrupted in chronic pain and how it is altered by treatments for chronic pain—including surgery, medications and cognitive-behavioural therapy. This will improve our understanding of the mechanisms underpinning chronic pain, which will be instrumental for developing more effective and personalized therapies for this debilitating condition.”

Cheng JC et al. Neuroimage. 2017 Aug 15;157:61-68. Supported by the Canadian Institutes of Health Research and the Toronto General & Western Hospital Foundation.
“When I play hockey, my mind is so focused on the game and scoring a goal that I don’t feel my recurring back and knee pain,” confides Dr. Davis, an avid hockey player and Leafs fan.
Images: (panel on left) Dr. Davis is pictured in her hockey gear; (on this page) the battle that takes place in the brain between pain and attention is illustrated by two hockey players facing off.
The best defence is a good offence. This adage, often applied to sports or military strategies, suggests that attacking one’s opponent offers the greatest protection. Researchers and clinicians are taking this approach to fight cancer—developing powerful new therapies that seek out and kill cancer cells.

One such approach is immune therapy: it works by boosting the number and activity of tumour-infiltrating lymphocytes (TILs), immune cells that go on the offensive by migrating into tumours to target and destroy them. Although this strategy holds promise, challenges remain because certain tumours have developed defence mechanisms that block TIL activity.

These tumours, however, are no match for Dr. Pamela Ohashi. She is a pioneer in figuring out how the immune system interacts with cancer in order to develop new immune therapies.

In an article published in the prestigious journal Nature Medicine, Dr. Ohashi and her research team revealed that an internal battle may be going on: they found that certain ovarian tumours contain other immune cells, called regulatory innate lymphoid cells (ILCregs), that block the activity of cancer-fighting TILs. The ILCregs did this in two ways: they reduced the ability of TILs to grow and multiply, and altered the ability of the TILs to attack cancer cells.

The team also found that the tumours from some patients contained ILCregs, while those from others did not, suggesting that some tumours may be able to attract or promote growth of ILCregs.

“By looking at tumour biology from this different perspective, we have a better understanding of the barriers that prevent a strong immune response,” explains Dr. Ohashi. “Our research reveals a promising new strategy to develop combined therapies that simultaneously target ILCregs while promoting TIL growth and function—delivering a stronger ‘one-two punch’ against the disease.”

Building on these findings, her team is now developing a test to identify ILCregs in patients, which may help predict whether the patient will respond to immune therapy. Dr. Ohashi says, “This knowledge would help doctors and patients make more informed medical decisions, personalize cancer treatment and ultimately improve the effectiveness of immune therapies.”

Immune therapies work by helping the immune system to target and kill cancer.

Crome SQ, et al. Nat Med. 2017 Mar;23(3):368-375. Supported by the Canadian Institutes of Health Research, the Cancer Research Institute/Irvington Institute, the Canada Foundation for Innovation, the Ontario Ministry of Research, Innovation and Science, the Alexander von Humboldt Foundation, the German Research Council, the National Institutes of Health, the Parker Institute for Cancer Immunotherapy and The Princess Margaret Cancer Foundation. P Ohashi is a Tier 1 Canada Research Chair in Autoimmunity and Tumour Immunity.

Image: (opposite page) just as a chess player uses offensive and defensive strategies to win, Dr. Ohashi is finding ways to weaken cancer’s defences while boosting the body’s immune system.
How you speak says a lot about you. A hurried voice can show that you are in a rush, while the tone of your voice can reveal emotion and mood.

How you speak can also uncover deeper truths: it can provide insight into your mental health. For example, speech can be used to diagnose aphasia, a disorder caused by brain damage that compromises an individual’s ability to speak, write or understand language.

“While speech analysis represents a powerful approach to diagnose certain disorders, this method typically relies on tedious ‘paper-and-pencil’ tests that are time consuming and costly to administer and interpret,” says Dr. Frank Rudzicz.

To address the shortcomings of traditional speech-based tests, Dr. Rudzicz’s team has combined subtle differences in speech patterns with the power of artificial intelligence (AI) to create a clinical tool that can quickly diagnose Alzheimer disease.

Alzheimer disease progressively damages the brain, impairing memory. Although memory loss is the most definitive symptom, speech may be a more sensitive indicator of brain function: not only do speech deficits appear early in the disease, but they also worsen as it progresses.

As a first step toward developing the new clinical tool, the research team identified the most prevalent speech deficits in Alzheimer disease. They did this by analyzing brief speech samples from 264 participants (167 with Alzheimer disease and 97 without).

For each audio sample, 370 features of speech were examined, such as vocabulary richness, vowel articulation and pauses between words. Next, the researchers used this data to teach an AI algorithm how to identify Alzheimer disease. The resulting speech-based diagnostic program was able to detect the disease with an accuracy of more than 80%. Not only is the new program just as accurate as traditional assessment methods, but it is faster, cheaper and more sensitive.

Dr. Rudzicz incorporated these findings into a set of assessment tools that can detect a variety of disorders including aphasia and types of dementia. This platform can also be used to monitor disease progression and the effectiveness of new treatments.

To bring this technology to market, Dr. Rudzicz co-founded the spin-off company WinterLight Labs. The result: an online app that is accessible and easy to use. From the comfort of their own home, patients can upload a short voice recording describing what they see in an image—such as a picture taken during a camping trip. Within seconds, the speech sample is analyzed to generate a set of scores describing speech deficits and mental function, which are then interpreted by clinicians.

WinterLight’s app offers a healthier future: one day your phone may be able to notify you at the earliest sign of disease so that preventative therapies could be started to help you stay healthy and active.

“WinterLight’s platform could help doctors make accurate diagnoses faster.”
That night it was clear and they had left so...
On Target for Cell Therapy

New method could lead to safer stem cell-derived diabetes treatments

Looking at things from a different angle can often lead to new and better solutions. That’s because a fresh perspective can help to inspire creativity, innovative thinking and collaboration.

It’s also why Dr. Cristina Nostro and her team recently embarked on a new collaborative project to solve a particularly difficult research problem: how to reliably isolate a specific pancreatic cell type capable of improving current treatments for type I diabetes.

Type I diabetes is a chronic condition in which cells in the pancreas—known as beta cells—are destroyed so little to no insulin is produced. Without insulin, the body is unable to keep blood sugar levels within a healthy range. When blood sugar levels remain consistently high for a prolonged period of time, serious conditions can develop, including heart disease, vision loss, kidney disease and nerve damage.

Transplanting healthy beta cells into the pancreas can restore insulin production and decrease the number of insulin injections needed to maintain normal sugar levels. However, widespread use of this treatment is hampered by a limited supply of donor beta cells for transplantation.

Using stem cells, Dr. Nostro has addressed this issue by developing a reproducible method for generating large numbers of cells that can safely give rise to insulin-producing beta cells. The technique, which mimics what occurs during pancreas development, forces stem cells to mature into daughter stem cells (pancreatic progenitors) that then develop into insulin-producing beta cells.

Unfortunately, the technique also produces progenitors that mature into cells that do not produce insulin. The problem: these contaminating progenitors need to be removed before the therapeutic insulin-producing cells can be safely used in the clinic.

Dr. Nostro teamed up with Dr. Thomas Kislinger to explore an entirely new approach to solving this problem. Together they identified specific proteins that are found on the surface of the pancreatic progenitors. They then used one of the proteins—known as Glycoprotein 2—to isolate the pancreatic progenitors and remove the contaminating cells. This allowed them to not only control the number but also the purity of the newly generated insulin-producing cells.

“Our long-term goal is to cure type I diabetes using transplants of insulin-producing cells, so it is crucial to have cells that are safe and pure,” explains Dr. Nostro. “The technique we’ve developed provides a better, more reliable method for generating large quantities of these cells for use in the clinic.”

Cogger KF, et al. Nat Comm. 2017 Aug 24;8(1):331. Supported by the McEwen Centre for Regenerative Medicine and the Toronto General & Western Hospital Foundation, the Banting and Best Diabetes Centre, the Canadian Institutes of Health Research, the Ontario Ministry of Health and Long-Term Care, the National Institutes of Health, the Juvenile Diabetes Research Foundation, the US Department of Veterans Affairs and the Vanderbilt Diabetes Research and Training Center.
“This new approach will help us to develop safer stem cell therapies for diabetes.”
In their quest to improve stem cell-derived diabetes treatments, Dr. Nostro (pictured) and her team developed an approach to reliably target and isolate insulin-producing beta cells (depicted as fluorescently labelled green and blue cells).
Within seconds, the WinterLight platform can analyze over 400 features in recorded speech samples to assess a person’s mental function.

To learn more, please visit the WinterLight Labs website: http://www.winterlightlabs.com/
Artificial Intelligence Feeds Need for Speed

Technology is being used to fast-track radiation therapy plans and conserve clinical resources

Radiation therapy is simple in its concept: high-energy radiation can damage and destroy cells, so beams of radiation are directed at a tumour to kill cancer cells. However, the treatment must also carefully minimize the dose to nearby organs.

Actually creating a plan that balances these conflicting requirements can be incredibly complex—it requires dedicated time from a team of highly trained experts. Each patient’s anatomy and tumour shape are unique, and it takes a lot of clinical resources and expertise to create a high-quality plan.

That may not be the case for much longer. Dr. Thomas Purdie and his team, including Dr. Chris McIntosh, have used the power of artificial intelligence (AI) to develop a new system that can create a high-quality plan in minutes—faster than current approaches, which can take days. The technology, known as AutoPlanning, uses machine learning to harvest information from a massive database of proven radiation therapy plans from Princess Margaret Cancer Centre.

While no two patients are identical, there can be similarities. The AutoPlanning AI can evaluate many features in a patient’s images, and find other patients in the database with similar features. Then, it builds a radiation therapy plan for the new patient based on information in the plans of patients with similar features.

With thousands of high-quality plans to learn from, the system rapidly adapts and optimizes the plan to suit the new patient.

“The technology allows radiation medicine teams to take on more complex cases and provide precision medicine to more patients,” says Dr. Purdie.

Earlier this year, UHN announced that AutoPlanning has been licensed to RaySearch Laboratories of Sweden with the help of UHN’s Technology Development and Commercialization Office. The deep learning algorithms of the AutoPlanning system will be integrated into RaySearch’s RayStation treatment planning system next year. Johan Löf, CEO of RaySearch, says, “This technology has the potential to make a huge contribution to patient care. I am delighted to be able to bring its benefits to centers around the world as part of the RayStation platform.”
From Building Blocks to BlueRock

BlueRock Therapeutics receives historic investment to advance stem cell research

Toronto’s stem cell and regenerative medicine ecosystem gained a major player with the establishment of a new biotechnology company, BlueRock Therapeutics, in December 2016. The company, co-founded by world-renowned UHN researchers, Drs. Gordon Keller and Michael Laflamme, will advance novel stem cell-based treatments for a variety of diseases, such as cardiovascular disease and Parkinson disease, in a state-of-the-art 10,000 square foot facility.

One of the first innovations that will be developed by the company is an approach to regenerate and repair damaged heart muscles, co-created by the two UHN researchers. Drs. Keller and Laflamme developed a way to coax stem cells into becoming specialized heart muscle cells called cardiomyocytes. These cells, when introduced into the heart, act like building blocks—incorporating into the heart tissue and making the heart stronger by repairing muscle damage caused by heart attacks or abnormal heart rhythms.

“We’ve had a lot of research breakthroughs in the past several years and with BlueRock we can now move them from the laboratory to the clinic to help patients,” said Dr. Laflamme during the launch event, which was attended by federal and provincial ministers and the Premier of Ontario.

BlueRock was made possible by Bayer AG and Versant Ventures, who provided US$225 million in seed funding. The funds, which represent one of the largest biotechnology investments in history, will be used to build and support research and development facilities in Toronto, New York and Boston. The Toronto facility will employ up to 70 scientists and technical staff when fully functional.

Sparked by the discovery of stem cells at UHN more than 50 years ago, the local stem cell research community is home to leading centres such as UHN’s McEwen Centre for Regenerative Medicine and the Centre for Commercialization of Regenerative Medicine. BlueRock now joins this vibrant cluster of excellence in regenerative medicine, reinforcing Toronto’s world-class reputation in the field.

BlueRock builds upon Toronto’s excellence in stem cell research.

“The concentration of stem cell research resources and expertise that we have is unparalleled,” says Dr. Keller, who is also the Director of the McEwen Centre. “Establishing BlueRock Therapeutics is a visionary move that will lead to new therapies for currently untreatable diseases.”

UHN’s Technology Development and Commercialization Office worked closely with all partners to negotiate and execute the license agreements for the foundational intellectual property, as well a master research agreement to fund future work.

Image: (L-R) Dr. Gordon Keller and Dr. Michael Laflamme.
Therapies are being developed by BlueRock that involve coaxing stem cells into becoming specialized heart muscle cells, which are reintroduced into damaged hearts to restore function.
Support

New funding spurs world-class innovation

Federal Support for Basic Research
UHN was the top-funded research hospital in the Canadian Institutes of Health Research’s 2016–2017 Foundation and Project Grant Program competitions.

For the Foundation Grant Program competition, UHN received a total of $22.9 million in funding for eight awards—representing the second highest number of awards given to a single institution and a success rate almost double the national average.

These projects were led by Dr. Cheryl Arrowsmith (gene packaging in cancer), Dr. Robert Chen (brain connections in movement disorders), Dr. Myron Cybulsky (immune cells in blood vessel disease), Dr. John Dick (leukemia stem cells), Dr. Mitsu Ikura (the role of calcium in cancer growth), Dr. Rama Khokha (genetic and environmental factors driving cancer), Dr. Aaron Schimmer (therapeutic strategies for leukemia) and Dr. Gang Zheng (nanotechnology for anti-cancer drug delivery).

Similarly, UHN fared well above the national average in the Project Grant Program competition, with 22 projects receiving a total of $17.9 million.

Funding Proactive Research
A team of researchers led by Dr. Rosemary Martino received US$8.5 million from the Patient-Centered Outcomes Research Institute. The funding will support a multi-site study, called PRO-ACTIVE, that will focus on evaluating the effectiveness of proactively providing therapy to help those with head and neck cancer who experience difficulty swallowing. These patients often experience serious difficulties swallowing as a result of the location of the tumour or the radiotherapy used to treat it.

Multidisciplinary expertise across UHN will support the study: Quantitative Imaging for Personalized Cancer Medicine will provide medical imaging and radiation therapy solutions to enhance the reliability of study data; and Health Informatics Research will customize technology solutions to support the high-quality collection of patient-reported outcomes and clinical research data.

PRO-ACTIVE was selected through a highly competitive review process in which patients, caregivers and other stakeholders joined scientists to evaluate the proposals.
Building Capacity for Innovation
The Canada Foundation for Innovation awarded $20.9 million to UHN for state-of-the-art research infrastructure. Through its Innovation Fund, two projects received large-scale awards. The first was the Princess Margaret Cancer Centre Precision Medicine Program (led by Dr. Brad Wouters), which was granted $11.8 million—the second largest award in this competition—to develop new ways of profiling tumours. The second, CenteR for Advancing Neurotechnological Innovation to Application (CRANIA) (led by Dr. Milos Popovic), was awarded $6.5 million to create new therapies for neurological diseases and conditions.

Advancing Cancer Immune Therapy
Two projects, led by UHN researchers Dr. Pamela Ohashi and Dr. Mathieu Lupien, were selected for funding by the Terry Fox Research Institute.

Dr. Ohashi will receive $5.41 million to advance her investigations into the use of cancer immune therapy—a strategy that uses the body’s immune system to kill cancer cells. A world-renowned pioneer in this field and the Co-Director of UHN’s Tumour Immunotherapy Program, Dr. Ohashi will use the funds to develop and evaluate new immune therapies for high-grade serous ovarian cancer, the deadliest type of ovarian cancer.

Dr. Lupien will receive $2.25 million towards his immune therapy research. His project will focus on advancing immune therapy for women with triple-negative breast cancer, a type of cancer that tends to have lower survival and higher recurrence rates.

These projects were two of six funded projects, representing approximately 30% of total funds awarded nationally.
Discovery

A selection of top research findings

Clearing the Way
Nanoparticles are microscopic particles that can be linked to anti-cancer drugs for delivery to tumours. While effective in experimental systems, nanoparticles often fail in patients because they become trapped in the liver and do not reach the tumour.

To identify the reason for this, a team led by Dr. Ian McGilvray and the University of Toronto’s Dr. Warren Chan examined how nanoparticles interact with liver cells. They found that nanoparticles slow down upon entry into the liver from the bloodstream—giving liver cells time to eliminate them from the body.


The Magnificent 17
A research team led by Dr. Jean Wang has developed a genetic test that better predicts which leukemia patients will respond to standard therapies. The test’s prediction is based on 17 genes found in leukemia stem cells, which are instrumental in disease initiation and recurrence.

The test was created to help those with a type of leukemia known as acute myeloid leukemia, which is notoriously difficult to treat: standard therapies fail in up to 60% of young adults and 85% of older adults with the disease.

By identifying which patients will not respond to standard therapies, the test could help avoid unnecessary treatments, and identify those who may benefit from more experimental or intensive treatment strategies. Plans are underway to evaluate the test in a clinical trial. Ng SW, et al. Nature. 2016 Dec 15;540(7633):433-437.

Stroke of Genius
This year, a first-of-its-kind app was launched to provide clinicians with best practice rehabilitation strategies for patients with arm impairments due to stroke.

The ViaTherapy app, developed through a global collaboration led by rehabilitation researchers Drs. Mark Bayley and Steven Wolf (Emory University), is the result of more than five years of research by a panel with expertise in physiatry, neurology and physical and occupational therapy.

The app assists physicians in recalling established stroke therapies and in learning about new ones, making it easier for them to evolve their treatment plans based on how far along the patient is in their recovery. www.viatherapy.org.
A Gut Reaction
A study led by Dr. Robert Inman showed that immune cells originating in the gut may promote disease in a form of arthritis known as ankylosing spondylitis (AS).

This type of arthritis is characterized by painful swelling in the back and neck joints that occurs when the immune system attacks the body’s cells.

Dr. Inman discovered a type of immune cell that develops in the gut—known as a mucosal-associated invariant T cell—and that promotes harmful joint inflammation.

These findings strengthen the possibility that immune cells originating in the gut play a role in AS, while providing new molecular targets that could inform the development of new treatments. Gracey E, et al. Ann Rheum Dis. 2016 Dec;75(12):2124-2132.

Assisted Dying at UHN
A report describing UHN’s implementation of an assisted dying program, led by Dr. Madeline Li, was published in the New England Journal of Medicine.

Since February 2016, medical providers in Canada have been delivering medical assistance in dying (MAiD) to eligible patients. However, there is little information on the best way to implement MAiD in a hospital. UHN’s report is intended to help address this knowledge gap.

Briefly, UHN’s program consists of voluntary medical teams who assess eligibility, ensure informed consent and deliver the intervention. It also includes a committee that provides oversight, reports metrics and stewards data. During its first year of operation, the program provided MAiD to 19 patients. Li M, et al. N Engl J Med. 2017 May 25;376(21):2082-2088.

Protecting Brains
More than 216 million people worldwide suffer from malaria, a disease caused by parasite-infected mosquitos. If left untreated, it can progress to cerebral malaria, which can cause irreversible brain damage and death.

Based on the observation that people with cerebral malaria have low levels of the protein Ang-1, Dr. Kevin Kain used experimental models to gain a better understanding of the role of Ang-1 in the disease. He found that Ang-1 protects blood vessels in the brain during cerebral malaria, and that treatment with Ang-1 improved survival compared to treatment with conventional therapy. These exciting findings suggest that Ang-1-based therapies can be developed and tested to improve outcomes for this globally relevant disease. Higgins SJ, et al. Sci Transl Med. 2016 Sep 28;8(358):358ra128.
Impact

How research at UHN is improving health care

Safety Device Inspired by Nature
NeuroShield has been referred to as an ‘airbag for the brain’. It was launched by Bauer, a leading hockey equipment manufacturer, at a press conference attended by the company’s spokesman and hockey legend Mark Messier.

The collar-like device sits around an athlete’s neck and applies a slight pressure, increasing the volume of venous blood in the brain. The excess blood creates a ‘cushion’ between the skull and the delicate tissues of the brain, protecting the latter against the microscopic damage caused by blows to the head. The concept for the device was inspired by the woodpecker’s physiology, which protects the bird’s brain while drumming its beak against trees.

Dr. Joseph Fisher was one of the three clinicians who developed NeuroShield. The device was evaluated for safety in clinical trials involving high school soccer and football players, although device’s ability to protect against concussions has not yet been validated. Q30 Innovations, a US-based research and development company, acquired the commercial rights for the device and partnered with Bauer to bring it to market.

A Superior Test for Sleep Apnea
An at-home sleep apnea test known as BresoDx is now available to Ontario patients for the first time as the result of a unique MaRS program.

The breakthrough device—invented by Drs. Hisham Alshaer, T Douglas Bradley and Geoff Fernie—is available at sleep clinics across the province. Ontario patients can use BresoDx to test for sleep apnea in the comfort of their homes rather than in a sleep laboratory. It is the first technology to complete the MaRS EXCITE program, an innovative initiative that accelerates the adoption of health technology in Ontario.

Sleep apnea affects around 10% of adults, yet fewer than 15% of North Americans who have the condition have been diagnosed. Left untreated, sleep apnea leads to chronic sleeplessness and an increased risk of developing more serious conditions such as stroke and heart failure.

By enabling the launch of BresoDx across the province, the Ministry of Health and Long-Term Care is paving the way for early diagnosis and treatment of sleep apnea.
Sights Set on Helping the World
MolecuLight i:X is a handheld device that uses fluorescence imaging to visualize bacteria in wounds. The device provides doctors with a quick readout of the status of wounds and infections—providing important health insights that are otherwise invisible to the naked eye.

The technology was developed at UHN by Dr. Ralph DaCosta and spurred the creation of the MolecuLight spin-off company. Now, it is poised for world-wide adoption: a distribution agreement has been signed between MolecuLight and UK-based Smith & Nephew that will put the technology into the hands of clinicians and patients around the world.

“MolecuLight i:X enhances clinicians’ ability to choose the right therapy, at the right time for their patient,” says Dr. Andy Weymann, Chief Medical Officer at Smith & Nephew. The device’s ability to visualize wounds and infections will help guide wound management and treatment, contribute to the monitoring of hospital-acquired infections, and aid hospital-based programs that aim to minimize unnecessary use of antibiotics.

Dr. Christopher Paige received the 2016 award for his work in immune-oncology. He developed a therapeutic approach whereby a patient’s cancer cells are removed, engineered to produce certain chemical messengers and re-introduced to the patient, which then stimulates immune cells to have potent anti-cancer activity. A clinical trial is now underway and the technology was licensed by the UHN company AvroBio Inc.
UHN Foundations
Making a difference by helping research grow

The Princess Margaret Cancer Foundation
Toronto General & Western Hospital Foundation
Toronto Rehab Foundation
This year, The Princess Margaret (PM) Cancer Foundation launched its Transformation Campaign. With a goal of raising $50 million in donations, the campaign supports a multi-phase project to transform the facilities at PM Cancer Centre—improving the patient experience from the moment they step through the doors.

Approximately one in six patients volunteers to participate in a clinical trial during their cancer journey. These patients collectively donate more than 26,000 blood samples each year toward finding new and improved ways of treating cancer. The efficient collection, management and storage of these precious samples are critical to bench-to-bedside research.

To this end, part of the Transformation Project will include a redesign of the Blood Collection Centre. It will undergo an expansion and reorganization to accommodate three more accessible collection stations, an expanded reception and waiting area and key functional upgrades.

The redesigned facility will enable blood samples to be analyzed in a more rapid and efficient manner, delivering robust information to scientists for discovering new ways to individualize cancer care. One such approach is the examination of circulating tumour DNA, which comprises genetic material that is released into the blood by certain tumours. By decoding the sequence of this genetic material, scientists can develop tests to monitor a patient’s response to therapy or to predict the effectiveness of novel anti-cancer drugs.

“This project will facilitate clinical research, helping to ensure that our world-class team can meet the individual needs of every patient,” explains Dr. Mary Gospodarowicz, Medical Director of the PM Cancer Centre.

By providing a seamless integration of research throughout the cancer journey, this highly functional transformation will advance the institution’s commitment to patient-centered care. It will also accelerate research and innovation of new treatments and technologies that put patients’ needs first.
A Night of Discovery
Toronto General & Western Hospital Foundation

The first Discovery Ball—a fundraising initiative led by Toronto General & Western Hospital Foundation—took place on October 15, 2016. The goal of the event was to promote the Krembil Research Institute’s research successes and raise money to support research into cures for diseases of the brain, spine, bones, joints and eyes.

A candid conversation between Krembil Director Dr. Donald Weaver and science communicator Jay Ingram was featured on the main stage. Researchers in attendance wore “ask me about my research” buttons, encouraging discussions on the valuable work happening at the Krembil and giving the philanthropists an opportunity to understand how important their contributions were to developing cures, while creating an air of collaboration and discovery.

The Discovery Ball was the brainchild of Stacey Krembil, who was also co-chair of the planning committee with Dr. Michael Baker, who hosted the event. The night was well attended, with nearly 400 distinguished guests, including philanthropists, UHN leadership and Krembil-affiliated researchers.

The event included a raffle for prizes such as a diamond rivière necklet and a live auction, hosted by broadcaster, award-winning writer and producer Husein Madhavji capped the event. The highest bidders won the opportunity to tour the labs of Dr. Weaver and Krembil Senior Scientist Dr. Mohit Kapoor, a prize that further underscored the discovery theme.

The event pairs people committed to advancing health care with Krembil researchers.

The event raised nearly $1 million to support research at the Krembil. Because of its success, the Discovery Ball will continue as a staple of the Toronto General & Western Hospital Foundation’s fundraising efforts, with the next event scheduled for October 2018.
At Toronto Rehabilitation Institute (TRI), researchers work tirelessly to develop new therapies and products that restore function after illness or injury and enable independent living within the community.

In October 2015, the Toronto Rehab Foundation launched its *Where Incredible Happens* campaign, which aims to raise $100 million to support TRI researchers, programs and facilities, which are instrumental in developing life-changing inventions. Inspired by TRI’s work, Dean Connor, the President and CEO of Sun Life Financial and a Vice-Chair of UHN’s Board of Trustees, agreed to lead the campaign.

Dean and his wife, Maris Uffelmann, demonstrated their personal commitment to the campaign through an incredible $1 million gift to support TRI’s Rehabilitation Engineering Lab (REL). REL is located at Toronto Rehab’s Lyndhurst Centre, home of Canada’s largest rehabilitation program devoted to spinal cord injuries.

"There are few moments in life when you have the power to significantly improve the lives of people around you," says Dean. "We are happy to be able to help.”

REL is led by Dr. Milos Popovic, the TRI Chair in Spinal Cord Injury Research, and employs more than 40 researchers, trainees and staff. Dr. Popovic’s research has yielded novel technologies—such as functional electrical stimulation therapy—that produce unparalleled levels of recovery in people affected by stroke or spinal cord injuries: they have improved patients’ balance and restored their ability to walk, reach and grasp objects. His research is also making important advances in brain-machine interfaces, functional assessment tools, rehabilitation techniques and neuroprosthesis systems.

Dean and Maris’s generous gift is enabling REL to undertake two high-risk, high-payoff projects. The funds are supporting trainees and staff examining the use of electrical stimulation to treat depression and of brain-machine interfaces to restore upper-limb function in stroke survivors.
Research Distinctions
Selected honours bestowed upon UHN researchers

**Dr. Elizabeth Badley**
2017 Distinguished Scholar Award, Association of Rheumatology Health Professionals

**Dr. Philippe Bedard**
2017 William E. Rawls Prize, Canadian Cancer Society

**Dr. David Cescon**
2017 Dr. Elizabeth Eisenhauer Early Drug Development Young Investigator Award, Canadian Cancer Trials Group

**Dr. Vinod Chandran**
2017 Young Investigator Award, Canadian Rheumatology Association

**Dr. B Catharine Craven**
2017 Award of Merit, Canadian Association of Physical Medicine & Rehabilitation

**Dr. Marcelo Cypel**
Tier 2 Canada Research Chair in Lung Transplantation (renewal)

**Dr. Karen Davis**
2017 Outstanding Pain Mentorship Award, Canadian Pain Society

**Dr. Daniel De Carvalho**
Tier 2 Canada Research Chair in Cancer Epigenetics and Epigenetic Therapy

**Drs. Daniel De Carvalho and Mathieu Lupien**
2017 Bernard and Francine Dorval Prize, Canadian Cancer Society

**Dr. Eleftherios Diamandis**
2017 Lifetime Achievement Award, Ontario Society of Clinical Chemists

**Dr. John Dick**
2017 Tobias Award Lecture, International Society for Stem Cell Research
2016 Gold Leaf Prize for Discovery, Canadian Institutes of Health Research
Tier 1 Canada Research Chair in Stem Cell Biology (renewal)
2017 Keio Medical Science Prize, Keio University

**Dr. Michael Fehlings**
2017 David Lostchuck Memorial Research Award, Canadian Spinal Research Organization

**Dr. Eleanor Fish**
2017 Leadership in Advocacy Award, Research Canada

**Dr. Mary Gospodarowicz**
2017 Wendy Lack Women of Action Scientific Award, Israel Cancer Research Fund

**Dr. Housheng Hansen He**
2017 New Investigator Award, The Terry Fox Research Institute

**Dr. Mitsuhiko Ikura**
Tier 1 Canada Research Chair in Cancer Structural Biology (renewal)

**Dr. Jonathan Irish**
President, American Head & Neck Society

**Dr. Michael Jewett**
2017 Exceptional Leadership in Patient Involvement in Cancer Research Award, Canadian Cancer Research Alliance

**Dr. Anthony Lang**
2017 MDS Pan-American Section Leadership Award, International Parkinson and Movement Disorder Society
Dr. Gary Levy
2017 Lifetime Achievement Award, Canadian Society of Transplantation

Dr. Andres Lozano
2017 Khwarizmi International Award, Iranian Research Organization for Science and Technology
2017 Bachmann-Strauss Prize for Excellence in Dystonia Research, Michael J. Fox Foundation for Parkinson’s Research

Dr. Mary Pat McAndrews
2017 Excellence in Research Award, Canadian League Against Epilepsy

Dr. Brian O’Sullivan
2017 O. Harold Warwick Prize, Canadian Cancer Society

Dr. Amit Oza
GOC Presidential Medal, Society of Gynecologic Oncology of Canada

Dr. Christopher Paige
2017 Leadership in Advocacy Award, Research Canada

Dr. Kara Patterson
2017 Innovation and Advancement Award, Ontario Physiotherapy Association

Dr. Trevor Pugh
2017 New Investigator Award, The Terry Fox Research Institute

Dr. Milica Radisic
2017 Steacie Prize for Natural Sciences, E.W.R. Steacie Memorial Fund
Tier 2 Canada Research Chair in Functional Cardiovascular Tissue Engineering (renewal)

Dr. Gary Rodin
2017 Bernard Fox Memorial Award, International Psycho-Oncology Society

Dr. Frances Shepherd
2017 Addario Lectureship Award, Bonnie J. Addario Lung Cancer Foundation
2017 Women for Oncology Award, European Society for Medical Oncology

Dr. Lillian Siu
Member, Board of Directors, American Association for Cancer Research

Dr. Charles Tator
Officer, Order of Canada (promotion from Member)

Dr. Ming-Sound Tsao
2016 Dr. Joseph Pater Excellence in Clinical Trials Research Award, Canadian Cancer Trials Group

Dr. Michael Tymianski
Member, Order of Canada

Dr. Murray Urowitz
2017 Distinguished Clinical Investigator Award, American College of Rheumatology

Dr. Sharon Walmsley
Member, Order of Canada

Dr. Minna Woo
Tier 2 Canada Research Chair in Signal Transduction in Diabetes Pathogenesis (renewal)

Dr. Bradly Wouters
Tier 1 Canada Research Chair in Hypoxia and the Tumour Microenvironment

Dr. Azadeh Yadollahi
Early Researcher Award, Ontario Ministry of Research, Innovation and Science

Dr. José Zariffa
Early Researcher Award, Ontario Ministry of Research, Innovation and Science
UHN Research Institutes

Krembil Research Institute

Princess Margaret Cancer Centre

Toronto General Hospital Research Institute

Techna Institute

Toronto Rehabilitation Institute
Krembil Research Institute

TOTAL RESEARCHERS 216
Total Appointed Researchers 92
Senior Scientists 31
Scientists 11
Affiliate Scientists 15
Emeritus 2
Clinician Investigators 33
Clinical Researchers 124

RESEARCH SPACE 154,001 sq. ft.

EXTERNAL FUNDING $52,659,561

TOTAL TRAINEES 120
Fellows 48
Graduate Students 72

TOTAL STAFF 276

PUBLICATIONS 947

Research Council
Director and Chair, Krembil Research Institute Donald Weaver
Division Head, Fundamental Neurobiology Peter Carlen
Division Head, Healthcare & Outcomes Research Aileen Davis
Division Head, Brain Imaging & Behaviour – Systems Neuroscience Karen Davis
Division Head, Genetics & Development James Eubanks
Co-Director, Donald K. Johnson Eye Institute Valerie Wallace
Clinical Representative, Arthritis Program Robert Inman
Research Director, Arthritis Program Mohit Kapoor
Medical Director, Arthritis Program Nizar Mahomed
Chair, Trainee Affairs Committee Frances Skinner
Executive Director, Research Operations Lisa Alcia
Vice President and Site Lead, Toronto Western Hospital Janet Newton
Executive Vice President, Science and Research Bradly Wouters

Researchers

Brain, Imaging & Behaviour-Systems Neuroscience
Senior Scientists
Jonathan Brotchie
Robert Chen
Karen Davis
William Hutchison
Sidney Kennedy
Andres Lozano
Mary Pat McAndrews
David Mikulis
Antonio Strafella
Scientists
Jonathan Downar

Affiliate Scientists
Mojgan Hodaie
Mark Gutman
Clement Hamani
Walter Kucharczyk

Fundamental Neurobiology
Senior Scientists
Peter Carlen
Frances Skinner
Shuzo Sugita
Michael Tymianski
Donald Weaver

Scientists
Jérémie Lefebvre
Ivan Radovanovic
Taufik Valiante

Affiliate Scientists
Magdy Hassouna
Liang Zhang
Georg Zoidl

Genetics & Development
Emeritus
Charles Tator
Senior Scientists
Cathy Barr

James Eubanks
Michael Fehlings
Robert Inman
Mohit Kapoor
Lyanne Schlichter
Elise Stanley
Joan Wither

Scientists
Nigil Haroon
Lorraine Kalia
Suneil Kalia
Armand Keating
Affiliate Scientist
Sowmya Viswanathan
Healthcare & Outcomes Research
Emeritus
Murray Urowitz
Senior Scientists
Elizabeth Badley
Aileen Davis
Dafna Gladman
Nizar Mahomed
Scientist
Anthony Perruccio
Affiliate Scientists
Vinod Chandran
Paul Fortin
Monique Gignac
Rosemary Martino

Patient-based Clinical Research
Senior Scientist
Anthony Lang

Donald K. Johnson Eye Institute
Senior Scientists
Philippe Monnier
Christopher Hudson
Valerie Wallace
Agnes Wong
Scientist
Jeremy Sivak
Affiliate Scientists
Moshe Eizenman
John Flanagan
Brenda Gallie
Esther González

Clinician Investigators
Dimitri Anastakis
Danielle Andrade
Heather Bältzer
Mark Bernstein
Anuj Bhattia
Michael Brent
Daniel Buchman
Frances Chung
Melanie Cohn
Robert Devenyi
Dean Elterman
Alfonso Fasano
Susan Fox
Kenneth Fung
Rajiv Gandhi
Timothy Jackson

Clinical Researchers
Ronit Agid
Jamal Ahmad
Peter Ashby
Yaron Avitzur
Brian Baker
Paul Binhammer
Jeff Bloom
Arthur Bookman
Sarah Brode
Richard Brull
Esther Bui
Yvonne Buys
Simon Carette
Leanne Casaubon
J David Cassidy
Rodrigo Cavalcanti
Jas Chahal
Clara Chan
Vincent Chan
Kenneth Chapman
Caroline Chessex
Angela Cheung
Ki Jinn Chin
Maria Cino
Michael Cusimano
J Roderick Davey
J Martin del Campo
Sherif El-Defrawy
W Mark Erwin
Richard Farb
Paul Fraser
David Frost
Alberto Goffi
Eyal Golan
Ewan Goligher
Allan Gordon
Brent Graham
Barry Greenberg
Raed Hawa
Robert Iwanochko
Sindhu Johnson
Ron Keren
Kyle Kirkham
Stephen Kraft
Timo Klings
Debbie Kwan
Jeffrey Kwong
Robert Lam
Wai-Ching Lam
Johnny Lau
Stephen Lewis
Joel Lexchin
Charles Lynde
Angela Mailis-Gagnon
Mark Mandelcorn
Pirjo Manninen
Katie Marchington
Samuel Markowitz
Patricia Marr
Connie Marras
Theodore Marras
Eric Massicotte
Steven McCabe
Azadeh Moaveni
Rakesh Mohankumar
Ali Naraghi
Ahtsham Niazi
Ivy Oandasan
Darrell Ogilvie-Harris
Allan Okrainec
Christian Pagnoux
Daniel Panisko
Christine Papoushek
Sagar Parikh
Philip Peng
Vitor Pereira
Anahi Perlas
Aleksandra Pikula
Atul Prabhu
Sidney Radomski
Sapna Rawal
Shail Rawal
Aylin Reid
Rowena Ridout
Jennifer Robblee
Sandra Robinson
Arjun Sahgal
David Salonen
Jorge Sanchez-Guerrero
Paul Sandor
Monica Scalco
Michael Schwartz
Hemant Shah
Colin Shapiro
Abdu Sharkawy
Sanjay Siddha
Frank Silver
Martin Simons
Jeffrey Singh
Mandeep Singh
Elizabeth Slow
Sumeet Sodhi
Neiles Soneji
Martin Steinbach
Barbara Stubbs
Khalid Syed
Peter Tai
Susan Talro
Maria Tassone
Karel terBrugge
Graham Trope
Karen Tu
Paul Tumber
Andrea Veljkovic
Alexander Velumian
Lakshmi Venkatraghavan
Herbert von Schroeder
Adam Weizman
Richard Wennberg
Robert Willinsky
David K Wong
David T Wong
Jean Wong
Eric Yu
Princess Margaret Cancer Centre

TOTAL RESEARCHERS 333
Appointed Researchers 82
Senior Scientists 44
Scientists 16
Affiliate Scientists 18
Assistant Scientist 1
Emeritus 3
Cancer Clinical Research Unit (CCRU) Members 251

RESEARCH SPACE 416,488 sq. ft.
EXTERNAL FUNDING $142,847,824
TOTAL TRAINEES 259
Fellows 124
Graduate Students 135
TOTAL STAFF 857
PUBLICATIONS 1,192

Research Council on Oncology (RCO)

Director, PM Cancer Centre; Chair, RCO; Chair, Executive Committee (Interim) Rama Khokha
Executive Committee Mitsuhiko Ikura, Rama Khokha, Mathieu Lupien, Pamela Ohashi, Gary Rodin, Aaron Schimmer, Vuk Stambolic, Ming-Sound Tsao, Brian Wilson, Gang Zheng
Chair, Appointments Committee Rama Khokha
Medical Director, Cancer Program Mary Gospodarowicz
Medical Director, Laboratory Medicine Program Runjan Chetty
Head, CCRU Amit Oza
Head, Medical Oncology and Hematology Amit Oza
Head, Radiation Medicine Fei-Fei Liu
Chief, Surgical Oncology Gelareh Zadeh
Executive Director, Research Operations Lisa Alcia
Senior Vice President and Site Lead, PM Cancer Centre Marnie Escaf
Executive Vice President, Science and Research Bradly Wouters

Researchers

Emeritus
Norman Boyd
Richard Hill
A Michael Rauth

Senior Scientists
Kenneth Aldape
Cheryl Arrowsmith
Sylvia Asa
David Brooks
Avijit Chakrabartty
Daniel De Carvalho
Gerald Devins
John Dick
Shereen Ezzat

Razqallah Hakem
David Hedley
Naoto Hirano
Doris Howell
Mitsuhiko Ikura
Norman Iscove
David Jaffray
Jennifer Jones
Igor Jurisica
Gordon Keller
Rama Khokha
Thomas Kislinger
Lothar Lilge
Fei-Fei Liu
Geoffrey Liu
Mathieu Lupien
Tak Mak
Tracy McGaha
Mark Minden
Benjamin Neel
Pamela Ohashi
Emil Pai
Christopher Paige
Linda Penn
Gilbert Privé
Brian Raught
Gary Rodin
Robert Rottapel
Aaron Schimme
Vuk Stambolic
Ming-Sound Tsao
I Alex Vitkin
Brian Wilson
Bradly Wouters
Gang Zheng
Camilla Zimmermann

Scientists
Laurie Ailles
Scott Bratman
Steven Chan
Ralph DaCosta
Kim Edelstein
Benjamin Haibe-Kains
Houusheng Hansen He
Michael Hoffman
Marianne Koritzinsky
Mohammad Mazhab-Jafari
Faiyaz Notta
Catherine O’Brien
Trevor Pugh
Rodger Tiedemann
Gelareh Zadeh

Assistant Scientist
Christopher Marshall

Affiliate Scientists
Mark Bray
Eric Chen
Phedias Diamandis
Ryan Dowling
Mary Jane Esplen
Anthony Joshua
C Anne Koch
Paul Kongkham
Robert Kridel
Benjamin Lok
Michael Moran
Michael Reedijk
Leonardo Salmena
Liran Shlush
Suzanne Trudel
Jean Wang
Paul Waterhouse
Wei Xu

Cancer Clinical Research Unit (CCRU)
Ayman Al Habeeb
Dominick Amato
Eitan Amir
Mostafa Atri
Michael Baker
Dwayne Barber
David Barth
Andrew Bayley
Nathan Becker
Philippe Bedard
J Robert Beecroft
Akbar Beiki-Ardakani
Jennifer Bell
Robert Bell
Alejandro Berlin
Hal Berman
Marcus Bernardini
Lori Bernstein
Andrea Bezjak
Ivan Blasutig
Scott Boerner
Penelope Bradbury
Anthony Brade
William Brien
James Brierley
Robert Bristow
Dale Brown
Karina Bukhanov
Ronald Burkes
Marcus Butler
Jeannie Callum
Marco Carlone
Angela Cashell
Charles Catton
David Cescon
William Chapman
Tanya Chawla
Christine Chen
Terry Cheng
Douglas Chepeha
Ranjit Chetty
Carol Cheung
Charles Cho
John Cho
Young-Bin Cho
James Chow
Caroline Chung
Peter Chung
Tae Bong Chung
Tulin Gil
Blaise Clarke
Sean Cleary
Tatiana Conrad
Tim Craig
Andrew Crean
Jennifer Croke
Michael Crump
Christine Cserti-Gazdewich
Bernard Cummings
Gilda da Cunha Santos
Norma D’Agostino
Laura Dawson
Jan Delabie
Uday Deotare
Neesha Dhani
Robert Dinniwell
Susan Done
James Downar
Daniel Drucker
Alexandra Easson
Elena Elimova
Christine Elser
Jaime Escallon
Andrew Evans
Hannaneh Faghfoury
Ronald Feld
Peter Ferguson
Sarah Ferguson
Carina Feuz
Antonio Finelli
Neil Fleshner
Warren Foltz
Jeremy Freeman
Anthony Fyles
Lucia Gagliese
Steven Gallinger
William Geddie
Fred Gentili
Sandeep Ghai
Sangeet Ghai
Danny Ghazarian
Ralph Gilbert
Caitlin Gillan
Meredith Giuliani
Rebecca Gladdy
David Goldstein
Pamela Goodwin
Chiara Gorrini
Mary Gospodarowicz
Rashmi Goswami
Anand Govindarajan
Paul Greig
Patrick Gullane
Abha Gupta
Vikas Gupta
Sara Hafezi-Bakhtiari
Masoom Haider
Sarah Hales
Robert Hamilton
Kathy Han
Toronto General Hospital Research Institute

Research Council

Director, TGHRI; Chair, TGHRI Research Council; Research Division Head (Acting), Experimental Therapeutics Mansoor Husain
Research Division Head, Advanced Diagnostics Myron Cybulsky
Research Division Head, Support, Systems & Outcomes Murray Krahn
Clinical Program Head, Transplantation Atul Humar
Clinical Program Head, Peter Munk Cardiac Centre Barry Rubin
Physician-in-Chief; Clinical Program Head, Medical & Community Care Edward Cole
Surgeon-in-Chief; Clinical Program Head, Surgical & Critical Care Shaf Keshavjee
Chair, TGHRI Appointments Committee Thomas Waddell
Group Lead, Communities of Health Shabbir Alibhai
Group Lead, Cardiovascular Slava Epelman
Group Lead, Infection & Immunity Adam Gehring
Group Lead, Respiratory & Critical Care Mingyao Liu
Group Lead, Metabolism Minna Woo
Executive Director, Research Operations Lisa Alcia
Senior Vice President and Site Lead, Toronto General Hospital Scott McIntaggart
Executive Vice President, Science and Research Bradly Wouters

Researchers

**Advanced Diagnostics**

Senior Scientists
- Johane Allard
- Peter Backx
- Daniel Cattran
- Myron Cybulsky
- I George Fantus

Researchers
- Eleanor Fish
- Jason Fish
- Joseph Fisher
- John Floras
- Tony Lam
- Gary Lewis
- Mingyao Liu

Affiliate Scientists
- Kumaraswamy Nanthakumar
- York Pei
- Bruce Perkins
- Barry Rubin
- James Scholey
- Katherine Siminovitch
- Michael Wheeler

Clinical Researchers
- Eldad Zackenshaus
- Li Zhang

**Scientists**

- Moumita Barua
- Filio (Phyllis) Billia
- David Cherney
- Bryan Coburn
- Shannon Dunn

**TOTAL RESEARCHERS** 397

<table>
<thead>
<tr>
<th>Appointed Researchers</th>
<th>149</th>
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<tbody>
<tr>
<td>Senior Scientists</td>
<td>63</td>
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</tbody>
</table>

**RESEARCH SPACE** 171,800 sq. ft.

**EXTERNAL FUNDING** $72,491,550

**TOTAL STAFF** 459

**TOTAL TRAINEES** 281

**TOTAL TRAINEES**
- Fellows 104
- Graduate Students 177

**PUBLICATIONS** 1,454

**RESEARCH SPACE**

**EXTERNAL FUNDING**

**TOTAL STAFF**

**TOTAL TRAINEES**

**PUBLICATIONS**
Slava Epelman  
Anthony Gramolini  
Tianru Jin  
Ana Konvalinka  
Heather Reich  
Clinton Robbins  
Jonathan Rocheleau  
Paaladinesh Thavendiranathan  
Daniel Winer  
Minna Woo  
Affiliate Scientists  
Donald Branch  
Hong Chang  
Peter Liu  
Philip Millar  
Anna Sawka  
William Stansfield  
Florence Wong  
Assistant Scientist  
Sonya MacParland

**Experimental Therapeutics**

**Senior Scientists**  
T Douglas Bradley  
Mark Cattral  
Marc de Perrot  
Niall Ferguson  
Herbert Gaisano  
Margaret Herridge  
Atul Humar  
Mansoor Husain  
Harry Janssen  
Kevin Kain  
Keyvan Karkouli  
Rupert Kaul  
David Kelvin  
Shaf Keshavjee  
Lakshmi Kotra  
Michael Laflamme  
Gary Levy  
Ren-Ke Li  
Nancy Olivieri  
Milica Radisic  
Vivek Rao  
Thomas Waddell  
Sharon Walmsley  
Richard Weisel  
**Scientists**  
Vijay Chauhan  
Chung-Wai Chow  
Marcelo Cypel  
Satya Dash

**Affiliate Scientists**  
Marisa Battistella  
Mamatha Bhat  
Gail Darling  
Gregory Downey  
Anand Ghanakar  
David Grant  
Raymond Hui  
Shahid Husain  
David Hwang  
Stephen Juvet  
Joel Katz  
Thomas Lindsay  
Tereza Martinu  
Cheri McGowan  
Raymond Reilly  
Sheila Riazi  
Heather Ross  
Michael Setton  
Markus Selzner  
Morris Sherman  
Darrell Tan  
Terrence Yau  
**Assistant Scientists**  
Andrzej Chruscinski  
Sara Santana Nunes  
Vasconcelos

**Clinical Researchers**  
Susan Abbey  
Peter Adamson  
Oyedele Adeyi  
Ganesh Annamalai  
Carmen Avila-Casado  
Mitesh Badiwala  
Mrinalini Balki  
Meyer Balter  
Joanne Bargman  
Carolina Barnett  
Alan Barolet  
W Scott Beattie  
Chaim Bell  
Lee Benson  
Matthew Binnie  
Robert Bleakney  
Andrea Boggild  
Isaac Bogoch  
Ari Breiner

**Support, Systems & Outcomes**

**Senior Scientists**  
Shabbir Alibhai  
Anne Bassett  
Claire Bombardier  
Angela Cheung  
Peter Cram  
Abdallah Daar  
Gunter Eysenbach  
Alastair Flint  
Allan Kaplan  
Moira Kapral  
Murray Krahn  
Douglas Lee  
Charmaine Lok  
Robert Nolan

**Affiliate Scientists**  
Ana Carolina Alba  
Anna Galliard  
Bettina Hansen  
Sarbjit Vanita Jassal  
Janet Raboud  
Valeria Rac  
Beate Sander  
Thomas Forbes  
Suzanne Fredericks  
Alan Fung  
Sherry Grace  
Brian Hodges  
M Jane Irvine  
Adrienne Kovacs  
Jane MacIver  
Gail McVey  
Nicholas Mitsakakis  
Kathryn Nichol  
Karen Okrainec  
Marion Olmsted  
Jacob Pendergrast  
Rima Styra  
George Tomlinson  
Alice Wei  
D Blake Woodside  
**Assistant Scientist**  
Andy Wong

**Clinical Researchers**  
Susan Abbey  
Peter Adamson  
Oyedele Adeyi  
Ganesh Annamalai  
Carmen Avila-Casado  
Mitesh Badiwala  
Mrinalini Balki  
Meyer Balter  
Joanne Bargman  
Carolina Barnett  
Alan Barolet  
W Scott Beattie  
Chaim Bell  
Lee Benson  
Matthew Binnie  
Robert Bleakney  
Andrea Boggild  
Isaac Bogoch  
Ari Breiner

**Support, Systems & Outcomes**

**Senior Scientists**  
Shabbir Alibhai  
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Murray Krahn  
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Andy Wong

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W Scott Beattie  
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Robert Bleakney  
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Ari Breiner

**Support, Systems & Outcomes**

**Senior Scientists**  
Shabbir Alibhai  
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Peter Cram  
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Moira Kapral  
Murray Krahn  
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Charmaine Lok  
Robert Nolan

**Affiliate Scientists**  
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Nicholas Mitsakakis  
Kathryn Nichol  
Karen Okrainec  
Marion Olmsted  
Jacob Pendergrast  
Rima Styra  
George Tomlinson  
Alice Wei  
D Blake Woodside  
**Assistant Scientist**  
Andy Wong

**Clinical Researchers**  
Susan Abbey  
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Ganesh Annamalai  
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Mitesh Badiwala  
Mrinalini Balki  
Meyer Balter  
Joanne Bargman  
Carolina Barnett  
Alan Barolet  
W Scott Beattie  
Chaim Bell  
Lee Benson  
Matthew Binnie  
Robert Bleakney  
Andrea Boggild  
Isaac Bogoch  
Ari Breiner

**Support, Systems & Outcomes**

**Senior Scientists**  
Shabbir Alibhai  
Anne Bassett  
Claire Bombardier  
Angela Cheung  
Peter Cram  
Abdallah Daar  
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Alice Wei  
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Andy Wong
Techna Institute

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Core Leads 9
Scientists 3
Affiliated Faculty 35

RESEARCH SPACE 27,820 sq. ft.

EXTERNAL FUNDING $11,586,816

TOTAL TRAINEES 21
Fellows 8
Graduate Students 13

TOTAL STAFF 106
Technology Development Team 45
Other Staff 61

TOTAL STAFF 106

PUBLICATIONS 346

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