Seeing Beyond

Achieving Health

2013 UHN Research Report

UHN Research Snapshot

Total Researchers	**837**
Fellows	778
Graduate Students	742
Total Trainees	**1520**
Support Staff	1596
Research Space	818,386 sq. ft.
Publications	2658
Total Funding	**$333,215,953**

University Health Network (UHN) consists of Princess Margaret Cancer Centre, Toronto General Hospital (TGH), Toronto Rehab (TR) and Toronto Western Hospital (TWH). 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).

UHN is Seeing Beyond

Expanding the horizons of health research

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

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

What drives medical researchers at UHN to make award-winning discoveries? What drives UHN's clinical teams to develop successful first-in-human treatments? What drives hospital managers at UHN to enable our hospitals to be living laboratories that devise and test novel approaches to care delivery? What drives the UHN family of Foundations, and the generous donors they serve, to make investments that underpin the resource-intensive requirements of a top research hospital? The answers lie in a drive to see beyond; beyond present limitations, beyond current understanding and beyond status quo solutions. The drive to see beyond opens a portal into a new world of possibilities for improved health.

When the shortage of high quality lungs left potential transplant patients dying on the waiting list, UHN's transplant team saw a new way to increase the supply of organs: take lungs that were unsuitable for transplant and restore them to a state suitable for transplantation. Years of effort paid off when the first patient took his first breath using a renovated lung. Since then, hundreds of patients have benefited as this technique has been adopted by transplant centres around the world.

The promise of regenerative medicine will only be realized if multipotential stem cells can be reliably channeled down precise cellular pathways to become mature specialized cells such as those that make insulin in the pancreas, collagen in the joints or heart cells that are able to contract. In every case, UHN's McEwen Centre for Regenerative Medicine researchers were able to see beyond blocked pathways of cellular development and devise cocktails and conditions that allow the specialized cells to emerge.

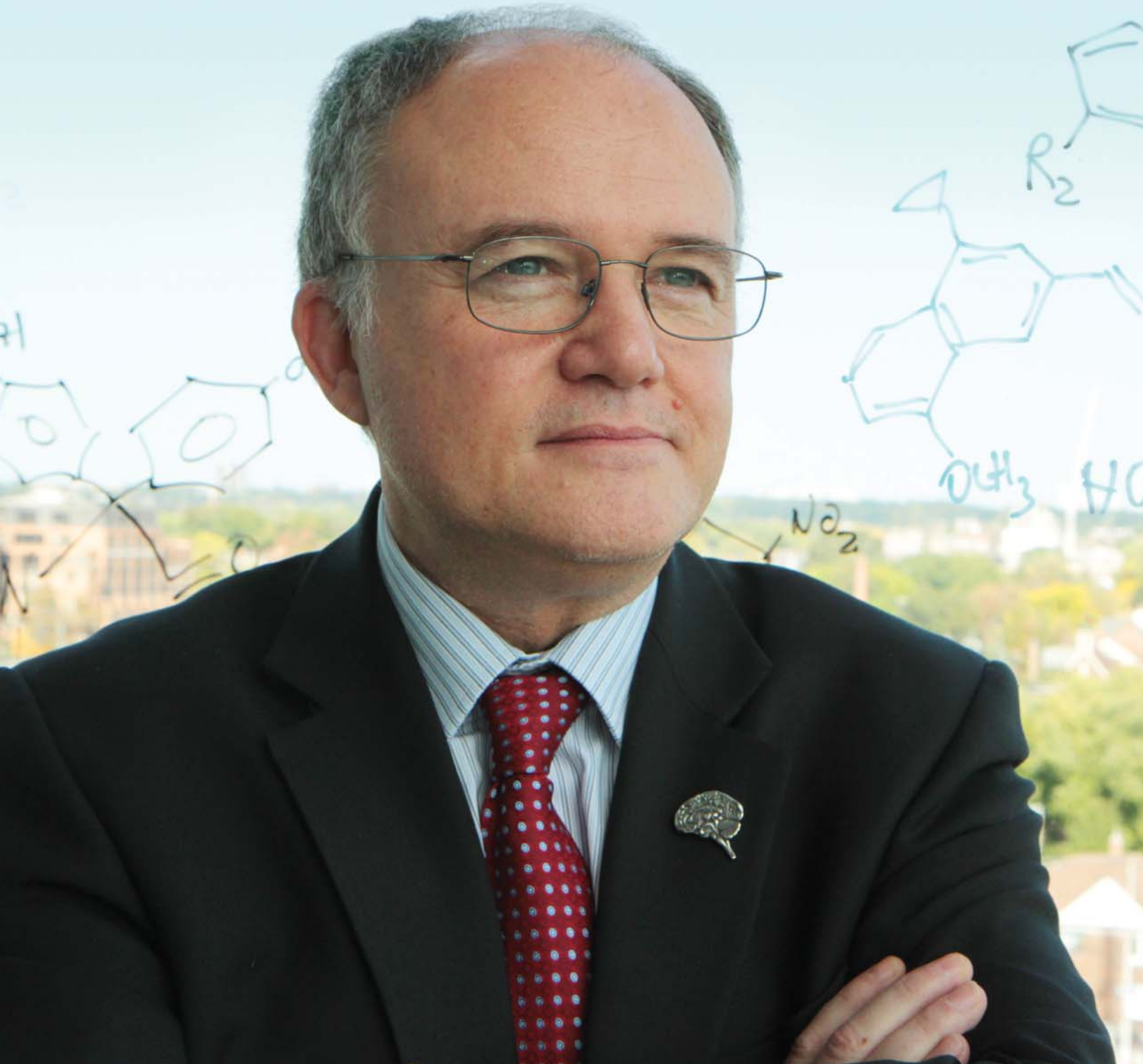
When care teams confronted the critical problems of pressure ulcers in patients being treated for certain conditions in our clinical inpatient programs, they applied lessons learned from continuous improvement techniques to turn problems into opportunities. Interventions were adopted to identify at-risk patients and implement strategies to prevent ulcer formation. Dramatic reductions in the percentage of patients with pressure ulcers rapidly followed. Care teams across UHN are challenged and empowered to see beyond what they do now to continually refine and improve care.

Even with four hospitals and five research institutes, UHN cannot do everything alone. Seeing beyond our "four walls" has been critical for developing initiatives with key partners such as the University of Toronto, the Toronto Academic Health Science Network hospitals and international collaborators. This has allowed for the creation and launch of programs such as the Toronto Dementia Research Alliance and the Phase 1 and 2 cancer clinical trials Consortia sponsored by the National Institutes of Health.

Perhaps the most remarkable ability to see beyond lies with the Foundations that support UHN—The Princess Margaret Cancer Foundation, Toronto General & Western Hospital Foundation, Arthritis Research Foundation and Toronto Rehab Foundation. Their vision and commitment has allowed UHN to become Canada's top-funded research hospital. Five thousand riders biking to Niagara Falls; an evening where top chefs and vintners from around the world gather in Toronto to entertain donors in private homes; coast-to-coast yoga enthusiasts stretching together on a Sunday afternoon; hundreds of Ontarians lacing up their running shoes to walk in support of cardiac rehabilitation—in every case the Foundations saw beyond traditional fundraising approaches to develop new ways to engage and unite our communities in supporting innovation in health care.

We invite you to read further and see beyond with UHN.

From East to the Western: New Leadership in Research



In July, Dr. Donald Weaver packed his bags, left Dalhousie University in Halifax, Nova Scotia and moved to Toronto. And UHN welcomed him with open arms as the new Director of the Toronto Western Research Institute (TWRI). Dr. Weaver, a neurologist and a medicinal chemist, brings with him an impressive array of clinical and research credentials, a fresh perspective on TWRI's future and an innovative research program of his own.

As the new Director, Dr. Weaver has a number of objectives supporting a strong vision for the Institute. "I envision TWRI becoming one of the top five medical research institutes that focuses on understanding human disease processes. The knowledge created will be used to produce innovative diagnostic and therapeutic products and tools for managing chronic diseases of the nervous system, including eyes, and the musculoskeletal system" he says. "Every night I pick a neuroscience institute somewhere in the world and I read about it, and think about how we're different and what insight I might bring here. Once I exhaust all the neuroscience institutes I'll start reading about all the arthritis research institutes."

His own research focuses on the applications of computer-aided drug design for the discovery and development of new potential therapeutics for neurological disorders, including Alzheimer's dementia and epilepsy. He is strongly involved in knowledge translation, commercialization and the creation of "micropharma" companies within the academic sector as a route to effective drug development—and he hopes to share this spirit with TWRI researchers in the translation of their own work as well.

"I'm going to engage researchers in knowledge translation and commercialization so that the end result is more than a publication, it's a product that helps people."

Dr. Donald Weaver

New Horizons of Discovery and Collaboration

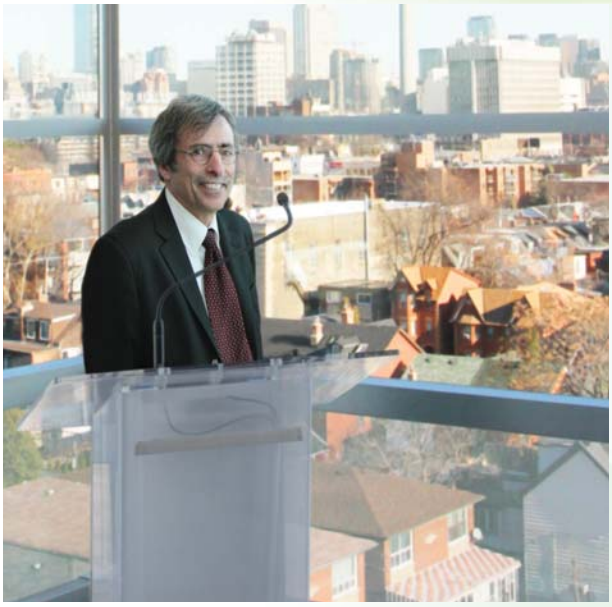
On November 20th, UHN began a new era of research with the official opening of the Krembil Discovery Tower (KDT).

At an event hosted by UHN and Toronto General & Western Hospital Foundation, donors and members of the research community were given a tour of this state-of-the-art research and clinical centre.

Construction of the nine-storey, $174 million building will increase TWRI research capacity by providing five floors of new research space. KDT will also be home to UT's Tanz Centre for Neurodegenerative Diseases and Altum Health, a UHN enterprise that provides unique rehabilitation solutions for injured workers and clients.

The innovative nature of the research to be conducted at KDT is reflected in the building's architecture. KDT was built as an open concept space that facilitates discussion and problem solving. Architects incorporated areas known as Sky Lobbies—communal two-storey high collaboration centres at each corner of the structure—to serve as informal areas where research teams can meet. The construction also followed Leadership in Energy & Environmental Design certification standards, which promote the highest standards for environmental stewardship and the creation of healthy indoor environments.

"KDT will be truly transformative for research at TWRI. These facilities will dramatically enhance our basic science and wet-lab based research capacity. Moreover, the open concept design will promote more efficient use of space and equipment while promoting important crosstalk among researchers." says Dr. Donald Weaver, TWRI Director.



"This state-of-the-art space will help UHN investigators advance innovative research on so many diseases that are debilitating to our aging population."

Dr. Christopher Paige, Vice President, Research

Bringing Best Practices to the World

With over 830 researchers and 818,386 square feet of research space, keeping research at UHN running smoothly is a challenge.

At the core of this endeavour is UHN's Research Support Services (RSS)—a program, established in 2000, that encompasses a suite of diverse tools and services to facilitate research. RSS ensures that the highest safety, quality and ethical standards are maintained within the wide spread of basic, translational and clinical research across UHN.

Other institutions in Toronto and across the world seek out these UHN-developed research tools, skills and insight in order to enhance their own research initiatives. These services are provided through UHN's MedRIST (Medical Research Integrated Solutions and Tools) program. Started in 2011, MedRIST offers consultation services to answer "big picture" questions, such as "How do we promote research that is likely to lead to clinical impact?", and logistical questions such as "How are specific research services established and maintained?" In Toronto, MedRIST provided services to Holland Bloorview Kids Rehabilitation Hospital and the Centre for Addiction and Mental Health. Internationally, MedRIST is guiding the creation of translational research programs in China (Jiao Tong University School of Medicine), the Middle East (Hamad Medical Corporation) and Brazil (A.C. Camargo Cancer Center).

MedRIST is also sharing a UHN-developed tool known as the Coordinated Approval Process for Clinical Research. This online service streamlines and simplifies the highly complicated processes involved in conducting clinical research, and is being customized for use by other Toronto hospitals. These "made at UHN" research support solutions have become resources with global appeal that have allowed UHN to build relationships that will impact and improve health care in Toronto and beyond.

"MedRIST initiatives help UHN to transform health research at an international level."

Lisa Alcia, Executive Director of Research Operations, RSS

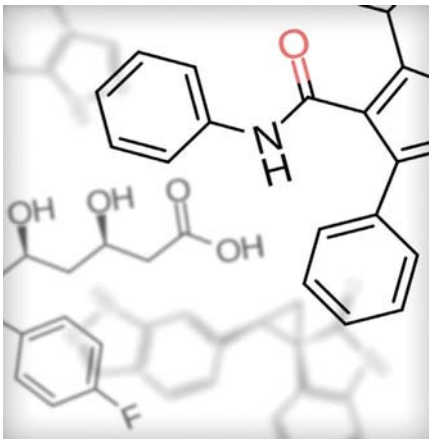
Fueling Discovery with Growth in Funding

Research funding plays an essential role in discovery, and over the last year UHN investigators continued their exceptional track record in securing support to facilitate their research programs. In July, a research team led by Dr. Kevin Kain was awarded a $5 million grant from the Preventing Preterm Birth Initiative—a global health program led by Seattle Children's that investigates the biological mechanisms that lead to preterm birth.

Funding success is key to driving the innovative projects across UHN that will improve health care for Canadians.

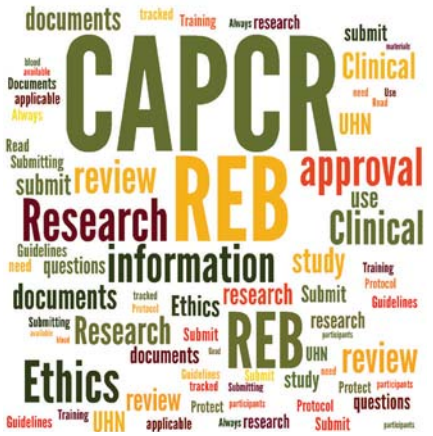
Investigators at UHN also obtained funding for infrastructure from the Canada Foundation for Innovation to help establish a Diabetes Discovery Core and a Centre for Cancer Epigenomics. Research in epigenomics also received a large financial boost from the Canadian Institutes of Health Research in partnership with Genome British Columbia, Fonds de recherche du Québec-Santé and the Japan Science & Technology Agency. These funds will support collaborative multinational research projects led by Drs. Cheryl Arrowsmith, John Dick and partners in Japan.

In addition, UHN celebrated the bestowing of three new Canada Research Chairs: Dr. Marcelo Cypel was awarded the Tier 2 Canada Research Chair in Lung Transplantation; Dr. Jason Fish secured a Tier 2 Canada Research Chair in Vascular Cell and Molecular Biology and Dr. Minna Woo obtained a Tier 2 Canada Research Chair in Signal Transduction in Diabetes Pathogenesis. Dr. Ren-Ke Li also successfully renewed his Tier 1 Canada Research Chair in Cardiac Regeneration.



UHN Portal Joins PubChem The National Institutes of Health's PubChem is a free database of chemical molecules. A complementary UHN database called SCRIPDB has recently been added to PubChem, joining the over 200 data sources that feed into it. Developed by Abraham Heifets in Dr. Igor Jurisica's lab, SCRIPDB provides PubChem with enhanced capabilities that allow users to search by chemical structure or similarity to access the patent text, chemical reactions or relationships extracted from existing patents.

Revealing the Future of Surgery The Guided Therapeutics Operating Room (GTx OR) opened earlier this year, providing UHN with a dedicated research OR within the existing TGH surgical hub. This advanced OR is three times larger than a standard OR and features image-based surgical navigation technologies. Designed to advance the application of novel surgical guidance devices in a real world setting, this facility will assess new surgical guidance prototypes for effectiveness and allow them to be safely integrated into surgical workflows.



Streamlining Clinical Research UHN's new Coordinated Approval Process for Clinical Research (CAPCR) system, which was launched late in 2011, is an online tool that streamlines the clinical research approval process. CAPCR is a web-based application that displays multi-departmental and committee approvals within a single platform. CAPCR became mandatory for all UHN clinical research in 2013, and since its launch has received over 1380 submissions involving 2530 users, and conducted over 7000 evaluations.

UHN Research

Medical Technology

Health Services Research

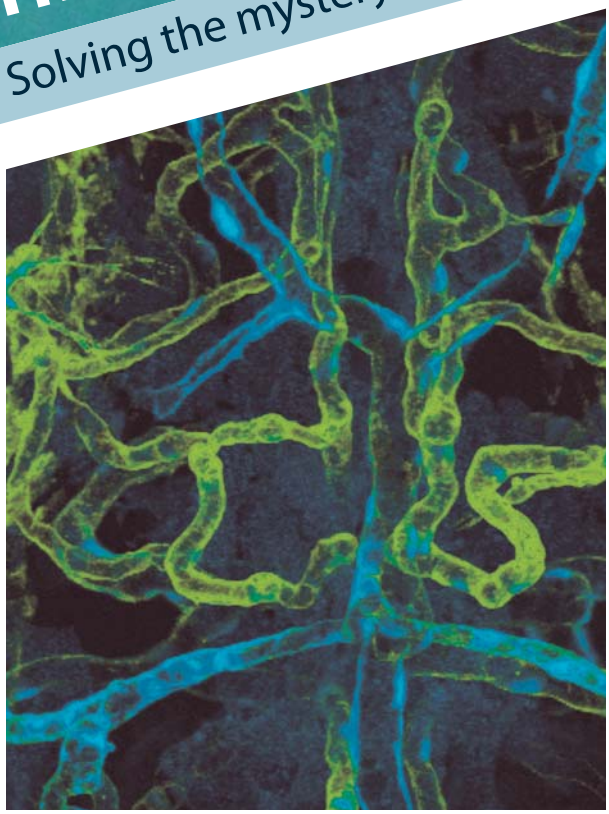
Experimental Therapeutics

Mechanisms of Disease

Regenerative Medicine

The Origins of Arteries

Solving the mystery of how arteries are born



The complex arteries and veins within the zebrafish used in this study are revealed in the image above. Zebrafish were engineered to express fluorescent protein in their arteries by Dr. Lan Dang. The image was taken by Emilie Boudreau.

Arteries, veins and capillaries comprise the main architecture of the circulatory system. Arteries are rigid vessels that deliver high-pressure oxygenated blood to the body, while veins, which are less rigid, return deoxygenated blood to the heart.

Abnormal artery growth and function have been implicated in diseases such as heart disease, in which arteries become weakened and blocked, as well as the difficult to treat disorder known as arteriovenous malformation. This condition can lead to bleeding in the brain and has been linked to epilepsy, severe headache and stroke.

The ability of researchers to develop effective treatments for these diseases is limited by the lack of understanding of the exact molecular events that work together to create arteries. Thus, the complex signals used by the body to tell a stem cell, which gives rise to arteries and veins in the developing embryo, to become one of these functionally and architecturally distinct vessels remain poorly defined.

What is currently known is that the process depends upon a complex series of events called a signalling cascade. These stepwise molecular

events serve to amplify developmental signals and to provide cells with their unique identities. Scientists have determined that during artery formation, a protein called Vascular Endothelial Growth Factor (Vegf) is released, which activates a second protein known as Delta-like 4 (Dll4). While Dll4 is a key player in supporting artery formation, exactly how Dll4 is activated in response to Vegf is unknown.

To shed light on this, Dr. Jason Fish used different experimental models and advanced molecular biology approaches to tease out the molecular events that control the creation of arteries.

Dr. Fish's research team, including postdoctoral fellow Dr. Lan Dang, graduate student Emilie Boudreau and collaborators at the University of California, San Francisco, found that Vegf activates proteins called Mitogen Activated Protein Kinases (MAPKs), which subsequently activate a group of proteins known as ETS transcription factors. These transcription factors are then responsible for activating Dll4.

Adding to these results, Dr. Fish found that another protein, known as Notch, which was believed to be required for Dll4 activation, may not be necessary. "Our results position Notch within a supporting role" says Dr. Fish, "And reveal that Notch may be more important for maintenance of arteries rather than early artery development."

Dr. Jason Fish

Seeing Beyond

By revealing the molecular cues that control artery formation, these results could provide critical insight to inform the development of new therapies for arteriovenous malformations. These findings are also relevant for coronary artery disease, in which the arteries supplying blood to the heart become weakened and blocked. To treat this condition a current procedure, known as heart bypass surgery, replaces damaged arteries with a vein; however the vein, which is less rigid than an artery, often becomes blocked. These results may contribute to the development of therapeutic solutions that strengthen grafted veins by coaxing them to take on more artery-like characteristics.

Wythe JD et al. Dev Cell. 2013 Jul. Supported by the American Heart Association; the National Institutes of Health; the California Institute of Regenerative Medicine; the Packard Foundation; the National Heart, Lung and Blood Institute; the Canadian Institutes of Health Research; the Ministry of Research and Innovation; and the Canada Foundation for Innovation. J. Fish is a Tier 2 Canada Research Chair in Vascular Cell and Molecular Biology.

Ankylosing Spondylitis

The road to earlier diagnosis and better treatment

Ankylosing spondylitis (AS) is a debilitating disease in which chronic inflammation occurs in the joints bridging the spine and pelvis leading to fusion of the spine in severe cases. The cause of this joint inflammation is currently unknown and remains a major challenge in AS research.

A recent study by Drs. Florence Tsui and Robert Inman provides new insight into the cause of AS by examining the body's immune response to Noggin (NOG) and Sclerostin (SOST), two proteins that regulate bone formation.

Dr. Tsui and her team found that proteins that bind to NOG and SOST—classified as autoantibodies—are present at higher levels in patients with AS than in healthy patients. These autoantibodies are able to bind to and block the normal functions of NOG and SOST, which likely contributes to new bone formation and eventual bone fusion in the spinal joints.

This is the first report to demonstrate that autoantibodies directed at an individual's own proteins are present in AS. Explains Dr. Tsui, "These findings suggest a possible link between autoimmunity and joint fusion in AS and provide the first evidence that AS is an autoimmune disease. More importantly, they hold the promise of realizing earlier diagnosis and better management of this devastating disease."

Dr. Tsui's findings have uncovered a role for autoantibodies in ankylosing spondylitis that will inform the development of new therapeutic approaches to treat the disease.

Tsui et al. Ann Rheum Dis. 2013 Jul. Supported by the Arthritis Society, the Canadian Institutes of Health Research (Institute of Musculoskeletal Health and Arthritis).

Customizing Cancer Treatments

Protein marker may lead to more effective therapies

A protein known as PTEN is defective in as many as half of all cancers. PTEN regulates the repair of damaged DNA and works by increasing the activity of another protein, PI3K.

Dr. Vuk Stambolic and his collaborators discovered that cells lacking PTEN are more susceptible to cell death if they are treated with a combination of a DNA-damaging agent, such as radiation therapy, and an inhibitor of PI3K. Interestingly, when cells lacking PTEN are treated with a DNA-damaging agent alone, they become more prone to developing alterations in their genome, including those that can cause cancer cells to grow faster or become more resistant to cancer therapies.

These studies reveal a new function for the PTEN protein, and may have important implications for how cancer patients are treated. The results suggest that patients with cancers that have defective PTEN would be less responsive if treated with a DNA-damaging agent alone.

Thus, more personalized treatment plans that take into account the PTEN status would greatly benefit patients. This potential approach is particularly well positioned because clinicians can already test for PTEN deficiency in tumours and there is ongoing development of agents to target PI3K, allowing these results to be rapidly translated into practice.

Dr. Stambolic's work advances personalized cancer medicine by identifying a gene that could be used to determine which patients benefit most from certain cancer treatments.

Bassi C et al. Science. 2013 Jul. Supported by the Canadian Cancer Society, the National Institutes of Health, the Ministry of Health and Long-Term Care and The Princess Margaret Cancer Foundation. B. Raught is a Tier 2 Canada Research Chair in Proteomics and Molecular Medicine, B. Neel is a Tier 1 Canada Research Chair in Signal Transduction and Human Disease and T. Mak is a Tier 1 Canada Research Chair in Inflammation Responses and Traumatic Injury.

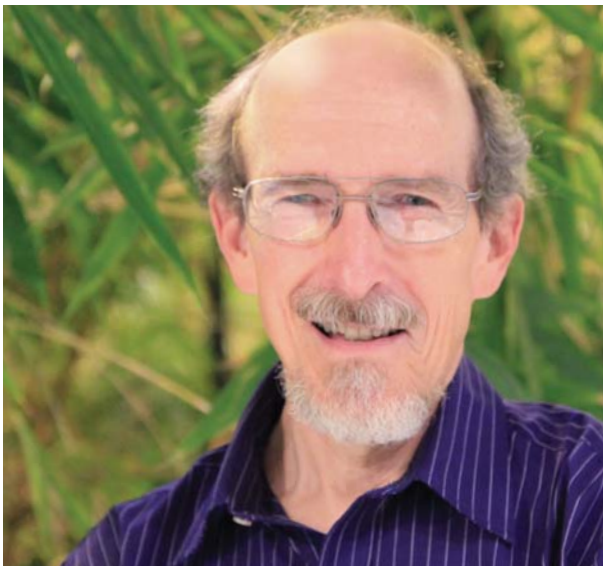
Self-Renewal of Stem Cells

Insights into the intricacies of blood formation

The production of blood is maintained throughout life from multipotential hematopoietic stem cells (HSCs)—these cells either develop into other blood cell types or give rise to identical stem cells in a process called self-renewal, which guarantees the permanence and ongoing process of blood formation. There are two types of HSCs: long-term multipotent HSCs (LT-HSCs), which can maintain certain types of HSCs and blood cells due to their ability to self-renew, and intermediate-term HSCs (IT-HSCs), which can only sustain specific HSC populations for about 12 weeks before cell numbers begin to diminish.

A study by Dr. Norman Iscove and his team sheds light on the role of a protein, called GATA-3, in controlling the self-renewal process. GATA-3 is already known to be involved in the development of immune cells, yet whether it plays a role in HSC self-renewal is unclear.

Dr. Iscove and his team showed that under certain conditions, GATA-3 is active in LT-HSCs and not IT-HSCs. Moreover, interfering with GATA-3 activity was found to increase the ability of LT-HSCs to self-renew and produce more HSCs. These findings provide valuable insight into developing techniques to increase the numbers of HSCs for use in bone marrow transplantation, a procedure that replenishes healthy blood cells in patients with blood cancers.



By identifying a molecular switch between self-renewal and differentiation for blood-forming stem cells, Dr. Iscove's research may help improve self-renewing stem cell yields for use in the clinic.

Frelin C et al. Nat Imm. 2013 Aug. Supported by the McEwen Centre for Regenerative Medicine, the Terry Fox Foundation, the Canadian Cancer Society, the Canadian Institutes of Health Research, The Princess Margaret Cancer Foundation, The Campbell Family Institute for Cancer Research, the Stem Cell Network and the Ministry of Health and Long-Term Care. J.-C. Zúñiga-Pflücker is a Tier 1 Canada Research Chair in Developmental Immunology.

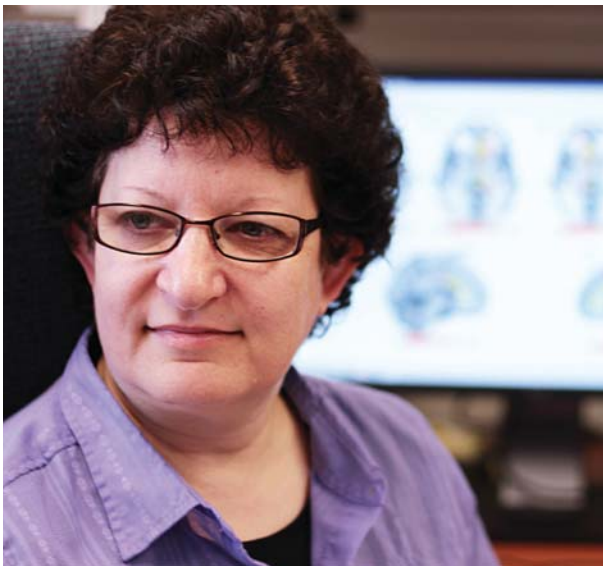
The Individuality of Pain

Linking brain structure and function to behaviour strategies

Pain is of great biological importance to survival and yet very little is understood about it. Intuitively, one would think that pain should interfere with the ability to sustain a high level of performance during an attention-demanding task, yet evidence shows that some individuals actually improve task performance during pain (attention to the task dominates; these people are designated A-type) while others show a decline in task performance during pain (pain dominates; these people are designated P-type). A recent study from Dr. Karen Davis (image, right) and postdoctoral fellow Dr. Nathalie Erpelding sheds further light on this by examining the psychophysical, psychological, brain structure and functional differences that may distinguish these behaviours.

By studying 80 subjects using experimental tasks and pain stimulation, they found that the A-types completed task experiments faster than the P-types during pain. Brain imaging further revealed that P-types had more gray matter in regions associated with pain and stronger neural connections in networks linked with sensing pain events. It also showed that A-types had stronger white matter connections with areas associated with motor and cognitive functions, presumably helping these individuals to perform tasks even during pain.

"The difference between these behaviours does not appear to be linked to such factors as gender or pain sensitivity," states Dr. Davis. "This exciting data reveals the neural underpinnings of how task performance versus pain is prioritized and could provide a framework for developing more personalized pain therapy approaches based on an individual's own behaviour and brain functional and structural organization."

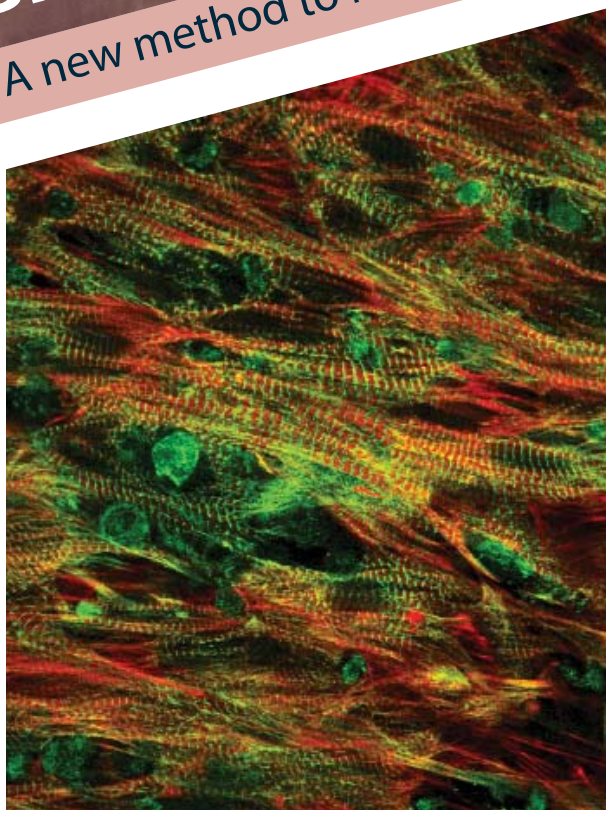


The next step in this area of research is to find out whether brain areas controlling these responses are malleable and if they can be changed by treatments such as cognitive behavioural therapy or brain stimulation.

Erpelding N et al. PAIN. 2013 Jun. Supported by the Canadian Institutes of Health Research.

Biowire: Tugging at the Heart Strings

A new method to make mature human cardiac cells



Actin filaments (red) and alpha-actinin (green) make up the contractile machinery of biowire-derived cardiomyocytes.

Differentiating stem cells into adult cardiac cells provides an attractive opportunity to create models of healthy and diseased cardiac tissue, screen new therapeutics for heart disease and repair cardiac tissue through transplantation.

Researchers have been exploring ways of growing personalized heart "patches" made from patients' own cells to repair failing hearts. However, efforts so far have led to limited success. Current techniques can only produce immature cells that lack important characteristics of adult heart cells.

During development, cardiac stem cells respond to local conditions and cues that determine the shape, connection and contractibility of adult heart cells. Recreating these conditions with stem cells provides a better environment to generate mature adult heart cells.

Drs. Sara Nunes de Vasconcelos and Milica Radisic, in collaboration with Drs. Gordon Keller, Peter Backx and Kumaraswamy

Nanthakumar, have developed a new method to make mature cardiac stem cells using a sterile surgical suture seeded with cardiac stem cells, known as a "biowire". The team recreated several physical, mechanical and electrical cues within the developing heart environment to allow for the maturation of cardiac stem cells.

The resulting biowire-grown cells mimic a number of adult cell characteristics: they are rod-shaped, can beat in unison, can be "paced" using electrical cues, do not multiply as much as immature cells and exhibit electrical activity similar to mature cells.

Dr. Nunes de Vasconcelos stresses that, "Further refinements are required to create true adult-like heart cells. Despite the early stage of this technology, the biowire serves as a promising platform to refine our ability to create functional heart cells for use in regenerative therapeutics and in drug screening platforms."

Nunes SS et al. Nat Methods. 2013 Jun. Supported by the the Ministry of Research and Innovation, the National Sciences & Engineering Research Council, the Canadian Institutes of Health Research and the National Institutes of Health. M. Radisic is a Tier 2 Canada Research Chair in Functional Cardiovascular Tissue Engineering and G. Keller is a Tier 1 Canada Research Chair in Embryonic Stem Cell Biology.

Dr. Sara Nunes de Vasconcelos

Seeing Beyond

The ability to generate more mature human cardiomyocytes from embryonic and induced pluripotent stem cells that better reflect adult characteristics has the potential to impact the lives of millions of people worldwide. Cardiac toxicity is one of the main causes of drug recall from the market due to side effects that were not detected in preclinical tests with animal models. As a consequence, preclinical drug screening using human adult-like cardiomyocytes could test these drugs before they reach the market, which would save billions of dollars and help to direct research to drugs that have a higher potential to be effective in patients without undesired side effects.

Brain Stimulation Improves Behaviour

Resetting the brain's circuitry to treat eating disorders

In a world first, a team of UHN scientists led by Dr. Andres Lozano have shown that deep brain stimulation (DBS) may help patients with anorexia to achieve and maintain improvements in body weight, mood and anxiety.

DBS is a surgical procedure in which electrodes are implanted into specific parts of the brain to moderate the activity of dysfunctional areas. DBS has been shown to be a safe and promising treatment for a number of disorders, including Parkinson's disease and major depression.

Dr. Lozano's team explored whether DBS could be effective against anorexia—an eating disorder and psychiatric condition characterized by food restriction, body distortion and an overwhelming fear of gaining weight. The study enrolled patients with hard-to-treat or "treatment resistant" anorexia, to examine whether DBS could serve as a safe and effective option for currently untreatable cases.

After a nine-month period following DBS surgery, the team observed that patients with anorexia had achieved weight gain. For these patients it was the longest period of weight gain since the onset of their illness. Patients also exhibited simultaneous changes in mood, anxiety, control over emotional responses, urges to binge and purge, and other symptoms related to anorexia.

"We are truly ushering in a new era of understanding of the brain and the role it can play in certain neurological disorders," says Dr. Lozano. "By pinpointing and correcting the precise circuits in the brain associated with the symptoms of some of these conditions, we are finding additional options to treat these illnesses."

By targeting and stimulating specific areas of the brain associated with a neurological disorder, clinicians now have a new approach for treating conditions in which traditional therapies have had little success.

Lipsman N et al. Lancet. 2013 Mar. Supported by the Klarman Family Foundation and the Canadian Institutes of Health Research. A. Lozano is a Tier 1 Canada Research Chair in Neuroscience.

Helping Lungs Breathe Easier

Clearing the air around a controversial therapy

Acute respiratory distress syndrome (ARDS) is a life-threatening condition where the lungs are unable to adequately absorb oxygen and release carbon dioxide. Mechanical ventilation of the lungs has been the standard form of ARDS supportive treatment; however, repetitive overstretching or collapse of the lung can cause inflammation, organ failure and death.

Previous studies have suggested that the delivery of very small volumes of oxygen at very high rates, in the form of high-frequency oscillatory ventilation (HFOV), could improve oxygen delivery and survival. However, these studies compared HFOV to outdated ventilation strategies, making it difficult to assess whether HFOV is beneficial by current standards of care for ARDS. Furthermore, only a limited number of participants were enrolled in the trials, adding to the uncertainty of the results.

To assess the true impact of HFOV, a rigorous, international multicentre clinical trial was led by Dr. Niall Ferguson. Over 500 patients participated from countries that included Canada, the United States, Saudi Arabia, Chile and India.

When HFOV was compared to current ventilation strategies, Dr. Ferguson's team unexpectedly found that mortality rates were higher in ARDS patients treated with HFOV. In addition, HFOV-treated patients had higher mean airway pressures and were treated more often with vasoactive and sedative drugs, which suggests that HFOV may be causing additional harm.

While mechanical ventilation can harm already damaged lungs, new "high-frequency" ventilation protocols offer no benefit and may actually be more harmful.

Dr. Ferguson concludes, "Our results raise serious concerns about the early use of HFOV, which does not reduce mortality and may be harmful in the management of ARDS in adults."

Ferguson ND et al. NEJM. 2013 Jan. Supported by the Canadian Institutes of Health Research. D. Cook is a Tier 1 Canada Research Chair in Research Transfer in Intensive Care

Changing Palliative Care Delivery

Earlier referrals can lead to better care

The health care needs of patients with advanced cancers are often highly complex and require treatment plans that can effectively address their physical and psychosocial symptoms. This care may be best provided by multidisciplinary teams through specialized palliative care services that take a holistic approach to treatment. Unfortunately, most terminally ill patients only receive palliative care services within thirty or sixty days of death and sometimes only in the last days of life.

A recent study by Dr. Camilla Zimmermann examined this issue by investigating the referral practices of oncologists across Canada. After surveying more than 600 oncologists, Dr. Zimmermann and her team found that most oncologists usually or always referred their patients for palliative care. However, oncologists who had more comprehensive and readily available services tended to refer their patients for palliative care earlier, as did those oncologists who had access to services that accepted patients still receiving chemotherapy.

Explaining the findings of the study, Dr. Zimmermann says, "Patients with cancer have many complex physical and psychosocial problems that don't necessarily manifest late in the disease course. Palliative care teams and oncologists need to work together more to provide holistic care for cancer patients at all stages of their disease."

Incorporating palliative care earlier in patient treatment plans will help to ensure that patients get the best possible care at every stage of their disease.

Wentlandt K et al. J Clin Oncol. 2012 Oct. Supported by the Canadian Cancer Society, The Princess Margaret Cancer Foundation and the Ministry of Health and Long-Term Care.

Setting the Standard

Creating quality benchmarks for radiation therapy across Ontario

Cancers of the prostate, head and neck, and central nervous system are often treated using intensity-modulated radiation therapy (IMRT). This technique uses detailed three-dimensional maps of the tumour to deliver precise doses of radiation to the cancer while minimizing exposure to healthy tissue. Given the complexity of the technique, which requires various specialists, computer algorithms and specialized equipment, there is currently much variability in how IMRT is administered in different hospitals across Ontario.

To address this, Dr. David Jaffray and Radiation Physicists Drs. Daniel Létourneau and Andrea McNiven are leading an initiative called the Collaborative Quality Assurance program, which aims to establish Ontario-wide IMRT standards. The quality control process uses end-to-end tests to cover every aspect of radiation therapy, from initial imaging and planning to dose delivery and measurement. Dr. McNiven personally visited each Ontario site to ensure consistency in the measurement techniques and to help troubleshoot any problems.

The program's first year has been successfully completed, with IMRT planning and delivery evaluations compiled across 13 radiation therapy centers. Dr. Jaffray comments, "We have successfully assessed treatment processes and established IMRT quality and safety targets for head and neck cancers, which will be expanded over the next four years to other cancers. This initiative will ensure that patients treated with IMRT will receive the highest quality of care across Ontario."

Dr. David Jaffray hopes the program will improve radiation therapy practices in the province and set targets for continued quality improvement.

Létourneau D et al. Int J Radiat Oncol Biol Phys. 2013 May. Supported by Cancer Care Ontario and The Princess Margaret Cancer Foundation.

Designing Smarter Wheelchairs

Helping older patients reclaim their mobility

Adults who suffer from limitations in attention, reflexes and memory often have difficulty using powered wheelchairs safely. Without another means of transport, these older adults are left with reduced mobility and a lack of independence. To address this problem, Dr. Alex Mihailidis has been evaluating a new intelligent wheelchair system (IWS) that was developed at the University of Toronto's Intelligent Assistive Technology and Systems Lab, in collaboration with researchers at the University of British Columbia and as part of the CanWheel Emerging Team.

The IWS system provides powered wheelchairs with an anti-collision feature, which helps to prevent the chair from running into obstacles, and a navigation assistance feature, which plays audio prompts to help users maneuver around objects. Dr. Mihailidis and his team found the IWS system to be effective at preventing collisions and navigating around obstacles in simulated environments. The system was also effective at limiting the number of collisions experienced by elderly study participants completing an obstacle course.

Explains Dr. Mihailidis, "There is concern that older adults with cognitive impairments could cause collisions or accidents when using powered wheelchairs. In many institutions, this concern has barred the use of powered wheelchairs entirely. Our study shows that IWS may improve powered wheelchair safety and usability in older populations."

Smart wheelchairs have the potential to increase the accessibility and safety of powered wheelchairs for older adults.

How TV et al. J Neuroeng Rehab. 2013 Aug. Supported by the Natural Sciences & Engineering Research Council of Canada and the Canadian Institutes of Health Research CanWheel Emerging Team in Wheeled Mobility for Older Adults.

Good Doctor, Better Doctor

How surgical culture affects error

A key skill of a good surgeon is the ability to cope with the unexpected during routine surgical procedures. Of particular importance is the ability to shift to a heightened state of mindfulness that has been described as "slowing down when you should." However, surgeons are expected to act decisively and with confidence—a product of the medical culture and expectations within the operating room. Thus, an internal conflict may arise in the decision-making process of surgeons.

Dr. Carol-anne Moulton addresses this conflict by providing a conceptual framework to better understand the expectations placed on surgeons and how these may be involved in surgical error. She explores the "hidden curriculum"—where surgeons-in-training learn through example to display characteristics such as decisiveness, speed, optimism and confidence.

It is suggested that this "surgical identity," which provides surgeons with the ability to persevere in the face of obstacles, must be tempered by a willingness to show uncertainty and seek help when necessary.

"Developing this framework will help surgeons become aware of the social pressures placed on them, so that they can better manage the conflicting feelings that arise during uncertain situations," stresses Dr. Moulton.

As the responsibilities and reputation of a surgeon increase, so do the pressures to show confidence and certainty. Dr. Moulton's research explores how these factors impact physician error.

"This awareness will make surgeons more likely to stop and think, to ask for help when needed, and to more fully devote the mental resources required to resolve problems, thereby reducing surgical error."

Jin CJ et al. Ann Surg. 2012 Dec. Supported by Physicians' Services Incorporated Foundation and the Ministry of Research and Innovation.

Building Brains from Brawn

Resistance training may help recovery after a stroke

A stroke occurs when blood flow to a specific region of the brain is impeded. The resulting loss of oxygen and brain damage can lead to highly specific motor disabilities, such as loss of the ability to use one limb, or paralyses on one side of the body. Finding ways of improving brain function after stroke, which is a leading cause of disability in North America, is an ongoing area of focus at UHN.

While studies have shown that aerobic exercise, such as walking and cycling, can enhance motor function, it has been suggested that building muscle mass (measured as fat-free mass) may promote neurological function. Thus, exercise programs incorporating weight or resistance training may be particularly beneficial for patients that have suffered a stroke. To explore this possibility Dr. Dina Brooks and postdoctoral fellow Dr. Susan Marzolini led a study that enrolled 41 stroke patients in a combined aerobic and resistance training program.

Participants attended weekly 90-minute exercise classes and completed supplemental at-home aerobic and resistance training sessions. After the six-month study, the number of people with memory, language, thinking and attention problems fell by nearly half. Furthermore, the results of the study allowed Dr. Brooks' team to directly link increases in muscle mass with improved brain function.

Dr. Brooks explains, "For the first time, we have been able to show that, in stroke patients, increased fat-free mass in the context of exercise training leads to improved cognitive function. Thus, our work further supports the concept that resistance training may be beneficial for poststroke recovery."

Drs. Dina Brooks (R) and Susan Marzolini (L) demonstrate use of the Biodex equipment, which measured improvements in stroke-related movement disorders in response to resistance training.

Marzolini S et al. Neurorehabil Neural Repair. 2013 Jun.
Dr. Dina Brooks is a Professor in the Department of Physical Therapy at the University of Toronto and a Scientist at West Park Healthcare Centre. Supported by the Heart and Stroke Foundation Centre for Stroke Recovery and the Ministry of Health and Long-Term Care through the Provincial Rehabilitation Research Program. D. Brooks is a Tier 2 Canada Research Chair in Rehabilitation for Chronic Obstructive Pulmonary Disease.

Research Distinctions

Dr. Kenneth Chapman
CIHR-GSK Research Chair in Respiratory Health Care Delivery, Canadian Institutes of Health Research

Dr. Angela Cheung
2012 Dr. David Sackett Senior Investigator Award, Canadian Society of Internal Medicine

Dr. Angela Colantonio
Research Chair in Gender, Work and Health, Canadian Institutes of Health Research

Dr. I George Fantus
Fellow, Canadian Academy of Health Sciences

Dr. Michael Fehlings
2013 Winn Award, Society for Neurological Surgeons;
2012 Jonas Salk Award, March of Dimes Canada;
2013 Henry Farfan Award, North American Spine Society;
Presidential Medal, Cervical Spine Research Society

Dr. Mary Gospodarowicz
President, Union for International Cancer Control;
Lifetime Achievement, European Society for Radiotherapy & Oncology;
2013 Janeway Medal, American Radium Society

Dr. Shaf Keshavjee
Order of Ontario, Ministry of Citizenship and Immigration

Dr. Tony Lam
Richard A Weitzman Memorial Award, Endocrine Society

Dr. Gary Lewis
Fellow, Canadian Academy of Health Sciences

Dr. Andres Lozano
Fellow, Canadian Academy of Health Sciences;
2012 Karolinska Institutet Olivecrona Medal, Karolinska Institute;
Tasker Award, World Society for Stereotactic and Functional Neurosurgery;
2013 Margolese National Brain Disorders Prize, University of British Columbia

Dr. Tak Mak
Fellow, American Association for Cancer Research

Dr. Rosemary Martino
Fellow, American Speech-Language-Hearing Association

Dr. Alex Mihailidis
President, Rehabilitation Engineering and Assistive Technology Society of North America

Dr. Goldie Nejat
Young Engineer Achievement Award, Engineers Canada

Dr. Milos Popovic
Morris (Mickey) Milner Award, Health Technology Exchange

Dr. Aaron Schimmer
Bernard and Francine Dorval Prize, Canadian Cancer Society;
2012 Till & McCulloch Award, Stem Cell Network

Dr. Michael Sefton
Gold Medal, The Professional Engineers of Ontario

Dr. Michael Tymianski
2012 Paul Morley Mentorship Award, Canadian Stroke Network

Dr. I Alex Vitkin
Fellow, The International Society for Optics and Photonics

Dr. Brian Wilson
Michael S. Feld Biophotonics Award, The Optical Society

Inventor of the Year

UHN's 2012 Inventor of the Year award was presented to medical physicist and Techna Faculty Dr. Thomas Purdie. The award, sponsored through UHN's Technology Development and Commercialization Office, honours a researcher that has made outstanding and inventive contributions to patient-oriented biomedical research.

Dr. Purdie received the award for his role in improving how cancer radiation therapy is delivered. He developed software that automates the analysis of diagnostic images and maps the tumour in a fraction of the time compared to traditional methods. This system has enabled breast cancer patients to be imaged, their data analyzed, and treatment administered in one day, and typically in less than three hours.

UHN Foundations

Arthritis Research Foundation

The Princess Margaret Cancer Foundation

Toronto General & Western Hospital Foundation

Toronto Rehab Foundation

Dance for the Cure

Arthritis Research Foundation

"I was diagnosed with Lupus in the prime of my life. When I was pregnant I was both thrilled and terrified; I felt awful. Lupus flares in pregnancy—we need to find out why and I know that research is the answer."

When Tiziana Tolfo was diagnosed with systemic lupus erythematosus (SLE) 25 years ago, she was in her final year of college. She loved horseback riding and was learning how to ski. After the diagnosis her life changed dramatically—the disease wreaked havoc on her body, leaving her with debilitating fatigue and requiring her to have multiple surgeries. In 1992, Tiziana decided she wanted to do something to help find a cure. What started out as a small party to raise money for research grew into an annual gala, *Dance for the Cure*, which hosts up to 800 people and has raised $1.3 million in total.

Tiziana's fundraising efforts support the Systemic Lupus International Collaborating Clinics (SLICC) and its Registry for Atherosclerosis in SLE. SLICC's international group of rheumatologists and lupologists hail from 33 centres that span 12 countries. The heart disease registry was started in 2001 to address the fact that women with SLE develop atherosclerosis at a higher rate and at an earlier age than the general population. These activities are coordinated at TWH under the direction of Dr. Murray Urowitz.

In February 2012, Tiziana and her team hosted the final *Dance for the Cure*. UHN is incredibly grateful for all they have done and their committment towards finding a cure for Lupus.

Top image: Flamenco dancers in action at the gala event. Bottom image (L-R): Vivian Risi, Joe DiMambro, Tiziana Tolfo, Mark Brunswick, Dr. Amanda Steiman.

Investing in People

The Princess Margaret Cancer Foundation

In January 2013, Emmanuelle Gattuso, her husband Allan Slaight and the Slaight family gave a huge boost to The Princess Margaret's Billion Dollar Challenge in support of Personalized Cancer Medicine with a historic donation of $50 million. This gift creates a "superfund" that will enable the cancer centre leaders to attract some of the world's brightest minds to UHN, where they will dedicate their energy and expertise to conquering cancer.

Emmanuelle has made it a personal priority to improve cancer care for Canadians. She and Allan began their philanthropic support with a donation of $1.5 million in 2001, which was used to create the first academic chair for breast surgical oncology in Canada. Shortly thereafter, Emmanuelle was diagnosed with breast cancer —after a stressful six-week wait from her initial mammogram to final diagnosis. In her drive and determination to effect positive change for cancer patients, she and Allan donated $20 million to turn a pilot project into a fully funded clinic that enables women with suspicions of breast cancer to complete all tests and receive their diagnosis in a single day.

"The generosity and leadership of Emmanuelle Gattuso and Allan Slaight will make a significant difference in what we are able to accomplish over the next decade," explains OCI Director Dr. Benjamin Neel. "It will enable us to substantially build up our expertise in important areas of cancer research—areas we believe hold tremendous promise for developing more effective treatments and durable cures."

Top image: Emmanuelle Gattuso. Bottom image (L-R): Allan Slaight and Emmanuelle Gattuso.

Stem Cells Made Personal

Toronto General & Western Hospital Foundation

Rob and Cheryl McEwen's support of the McEwen Centre for Regenerative Medicine continues to play a vital role in personalized medicine research. In 2013, they invested $2.76 million to establish the McEwen Centre's Facility and Program in Human Disease and Development.

The program will serve as a global hub for producing patient-specific stem cells and stem cell-derived tissues for studying the origins and progression of different human diseases, and developing new therapeutic strategies to treat them. "Creating this program is key to maintaining a leadership position in translating the findings from pluripotent stem cell research to the development of new therapies for disease." says Dr. Keller.

The power of this technology is exemplified by a recent collaborative study between the McEwen Centre, Columbia University and Boston University. The team took stem cells from a child suffering from Long QT Syndrome, a condition which results in severe and often lethal heart arrhythmia. Heart cells generated by Dr. Keller's team from the patient's stem cells mirrored the arrhythmia and helped inform a new drug therapy for the patient. This study demonstrates the potential of using stem cells to model diseases in the laboratory and represents a new personalized approach that furthers our understanding of disease processes and will help develop new therapies to treat them.

Top image: Dr. Gordon Keller, Director, McEwen Centre for Regenerative Medicine. Bottom image: Rob and Cheryl McEwen.

The Clifford Nordal Chair

Toronto Rehab Foundation

As our population ages, more people will be touched by conditions such as heart disease, stroke and diabetes—all of which may be linked to sleep apnea. Toronto Rehab Foundation was proud to announce that Dr. Douglas Bradley has been named the inaugural Clifford Nordal Chair in Sleep Apnea and Rehabilitation Research.

As Director of the UHN Sleep Research Laboratory and Senior Scientist, Dr. Bradley conducts groundbreaking research. His primary focus is on diagnosing and treating obstructive sleep apnea to prevent and alleviate cardiovascular diseases such as hypertension, heart failure and stroke, as well as reduce motor vehicle accident rates. He and his team have made a vital connection between sleep apnea and serious health concerns, prolonged stays in rehabilitation facilities and high costs to the health care system.

In conjunction with his colleagues, Dr. Bradley and his team found that stroke and heart failure patients have a much higher prevalence of sleep apnea than the general population. Subsequently, they demonstrated that treating sleep apnea with continuous positive airway pressure improved recovery from stroke, especially by improving mobility, and that treating sleep apnea in heart failure patients improved heart function.

Dr. Bradley's team, led by Hisham Alshaer, has also developed the revolutionary ApneaDx, a battery operated, wireless device to diagnose sleep apnea at home.

Top image (L-R): Clifford Nordal, Dr. Douglas Bradley, Dr. Eliot Phillipson. Bottom image: Dr. Douglas Bradley.

UHN Institutes

Ontario Cancer Institute

Techna Institute

Toronto General Research Institute

Toronto Rehab Institute

Toronto Western Research Institute


EXIT

Ontario Cancer Institute

Research Council on Oncology (RCO)

Director and Chair, RCO; Director, Executive Committee Benjamin Neel
Executive Committee Mitsuhiko 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 & Hematology Malcolm Moore
Head, CCRU Amit Oza
Chief, Surgical Oncology Jonathan Irish
Senior Clinical Vice President Marnie Escaf
Executive Director, Research Operations Lisa Alcia
Vice President, Research Christopher Paige

Research Snapshot

Research Space	383,338 sq. ft.
External Funding	$162,257,036
Publications	1135
Senior Scientists	47
Scientists	14
Affiliate Scientists	16
Assistant Scientists	4
CCRU Members	280
Total Researchers	361
Fellows	307
Graduate Students	242
Total Trainees	549
Total Staff	770

Researchers

Senior Scientists

Cheryl Arrowsmith
Sylvia Asa
Norman Boyd
Robert Bristow
Avijit Chakrabartty
Gerald Devins
John Dick
Shereen Ezzat
Lucia Gagliese
Brenda Gallie
Razqallah Hakem
David Hedley
Richard Hill
Doris Howell
Mitsuhiko Ikura
Norman Iscove
David Jaffray
Igor Jurisica
Gordon Keller
Rama Khokha
Thomas Kislinger
Lothar Lilge
Geoffrey Liu
Fei-Fei Liu
Tak Mak
Jeffrey Medin
Hans Messner
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
Ian Tannock
James Till
Ming-Sound Tsao
I Alex Vitkin
Brian Wilson
Bradly Wouters
Gang Zheng

Scientists

Laurie Ailles
Daniel De Carvalho
Kim Edelstein
Housheng Hansen He
Naoto Hirano
Mathieu Lupien
Nadeem Moghal
Catherine O'Brien
Hitoshi Okada
Trevor Pugh
Michael Roehrl
Rodger Tiedemann
Gelareh Zadeh
Camilla Zimmermann

Affiliate Scientists

Grace Bradley
Eric Xueyu Chen
Mary Jane Esplen
Mona Gauthier
Jennifer Jones
Anthony Joshua
C Anne Koch
Malcolm Moore
Michael Moran
Michael Reedijk
Paul Ritvo
Michael Sherar
Suzanne Trudel
Jean Wang
Julia Wang
Wei Xu

Assistant Scientists

Toshiyuki Araki
Ralph DaCosta
Zhenyue Hao
Leonardo Salmena

Cancer Clinical Research Unit (CCRU)

Hamideh Alasti
Ayman Al Habeeb
Eitan Amir
Mostafa Atri
Wing Au
Michael Baker
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
Scott Boerner
Jette Borg
Anthony Brade
Stephen Breen
William Brien
James Brierley
Dale Brown
John Bryson
Karina Bukhanov
Ronald Burkes
Marcus Butler
Marco Carlone
Charles Catton
Pamela Catton
Hong Chang
Tanya Chawla
Christine Chen
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
Catherine Coolens
Timothy Craig
Adrian Crawley
Andrew Crean
Sidney Croul
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 Dinniwell
Jason Dodge
Susan Done
James Downar
Alexandra Easson
Saibishkumar Elantholi Parameswaran
Mary Elliott
Christine Elser
Hala El-Zimaity
Jaime Escallon
Andrew Evans
Ronald Feld
Louis Fenkell
Peter Ferguson
Sarah Ferguson
Antonio Finelli
Neil Fleshner
Jeremy Freeman
Anthony Fyles
Karandeep Gaind
Steven Gallinger
William Geddie
Frederick Gentili
Sangeet Ghai
Sandeep 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
Vikas Gupta
Abha Gupta
Sarah Hafezi-Bakhtiari
Sarah Hales
Robert Hamilton
Kathy Han

Anthony Hanbidge
Robert Heaton
Mostafa Heydarian
Chia-Sing Ho
David Hodgson
Stefan Hofer
David Hogg
Andrew Hope
David Hwang
Elizabeth Hyjek
Jonathan Irish
Mohammad Islam
Nasir Jaffer
Hyun-Jung Jang
Michael Jewett
John Jezioranski
Kartik Jhaveri
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 Kim
Jennifer Knox
Hyang-Mi Ko
Paul Kongkham
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 Letourneau
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
Ozgur Mete
Ur Metser
Howard Michaels
David Mikulis
Barbara-Ann Millar
Naomi Miller
Kim Miller
Michael Milosevic
Chantal Morel
Lyndon Morley
Douglas Moseley
Carol-anne Moulton
Anna Marie Mulligan
Kieran Murphy
K Joan Murphy
Rumina Musani
Elsie Nguyen
Rinat Nissim
Nancy Olivieri
Anne O'Neill
Brian O'Sullivan
Amit Oza
Sophia Pantazi
Narinder Paul
Jacob Pendergrast
Bayardo Perez-Ordonez
Andrew Pierre
Anna Porwit
Thomas Purdie
Fayez Quereshy
Dheeraj Rajan
Golnar Rasty
Albiruni Razak
Donna Reece
Julia Ridley
G Jolie Ringash
Alexandra Rink
Heidi Roberts
Patrik Rogalla
Barry Rosen
Lorne Rotstein
Marjan Rouzbahman
Arjun Sahgal
Gilda Santos
Anabel Scaranelo
Andre Schuh
Matthew Seftel
Stefano Serra
Michael Sharpe
Patricia Shaw
Frances Shepherd
E Rand Simpson
Lillian Siu
Srikala Sridhar
Teodor Stanescu
Elizabeth Strevel
Alexander Sun
D Robert Sutherland
Carol Swallow
Joan Sweet
Jeff Tanguay
Mojgan Taremi
Bryce Taylor
Karel terBrugge
Santhosh Thyagu
Anne Tierens
Ants Toi
Emina Torlakovic
John Trachtenberg
Richard Tsang
Theodorus van der Kwast
Monique van Prooijen
Thomas Waddell
John Waldron
Richard Ward
Padraig Warde
David Warr
Alice Wei
Ilan Weinreb
Woodrow Wells
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

Leadership Team

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

Research Snapshot

Research Space	8561 sq. ft.
External Funding	$1,503,215
Publications	253
Core Leads	13
Faculty	1
Affiliated Faculty	32
Total Researchers	46
Fellows	11
Graduate Students	40
Total Trainees	51
Total Staff	39

Design & Engineering for Health

Core Lead
Joseph Cafazzo

Affiliated Faculty
Anthony Easty
Patricia Trbovich
Leonard Tse
Emily Seto

Guided Therapeutics

Core Leads
Jonathan Irish
David Jaffray

Faculty
Margarete Akens

Affiliated Faculty
Dionne Aleman
Timothy Chan
Catherine Coolens
James Drake
Gabor Fichtinger
Andrew Hope
Mohammad Islam
Andres Lozano
Claire McCann
Cynthia Ménard
Narinder Paul
Thomas Purdie
Dheeraj Rajan
Alexandra Rink
Michael Sharpe
Michael Sherar
Teodor Stanescu
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
Robert Wu
Christian Veillette

Nanotechnology and Radiochemistry

Core Leads
Ur Metser
Gang Zheng

Affiliated Faculty
John Valliant
Shyh-Dar Li

Photonics

Core Lead
Brian Wilson

Toronto General Research Institute

Research Council

Director and 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, Respiratory & Critical Care Mingyao Liu
Group Lead, Communities of Health Shabbir Alibhai
Executive Director, Research Operations Lisa Alcia
Clinical Vice President UHN; TGH Site Lead Scott McIntaggart
Vice President, Research Christopher Paige

Research Snapshot

Research Space	235,545 sq. ft.
External Funding	$73,189,347
Publications	936
Senior Scientists	53
Scientists	27
Affiliate Scientists	53
Assistant Scientists	2
Clinical Researchers	95
Total Researchers	230
Fellows	277
Graduate Students	173
Total Trainees	450
Total Staff	438

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
Gary Lewis
Peter Liu
Mingyao Liu
Kelly MacDonald
York Pei
Barry Rubin
Katherine Siminovitch
Michael Wheeler
Eldad Zacksenhaus
Li Zhang

Scientists
Shannon Dunn
Jason Fish
Anthony Gramolini
Tianru Jin

Tony Lam
Kumaraswamy Nanthakumar
Bruce Perkins
Heather Reich
Clinton Robbins
Allen Volchuk
Daniel Winer
Minna Woo

Affiliate Scientists

Donald Branch
Hong Chang
David Cherney
David Clark
Jeffrey Medin
Jonathan Rocheleau
Anna Sawka
Florence Wong

Experimental Therapeutics

Senior Scientists

T Douglas Bradley
Mark Cattral
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
Marc de Perrot
Jordan Feld
M Margaret Herridge
Keyvan Karkouti
Rupert Kaul
Lakshmi Kotra
J Andrea McCart
Ian McGilvray
M Cristina Nostro

Affiliate Scientists

Marisa Battistella
Denise Belsham
Limin Chen
Chung-Wai Chow
Gregory Downey
Stephen Fremes
Anand Ghanekar
David Grant
Raymond Hui
Shahid Husain
David Hwang
Joel Katz
Ping Lee
Thomas Lindsay
Cheri McGowan
Janet Raboud
Milica Radisic
Raymond Reilly
Sheila Riazi
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
Ronald Heslegrave
Allan Kaplan
Moira Kapral
Murray Krahn
Gary Rodin
Peter Singer
Donna Stewart
David Urbach

Scientists

Anna Gagliardi
Sherry Grace
Douglas Lee
Robert Nolan

Affiliate Scientists

Paula Barata
Patricia Colton
Caroline Davis
Gina Dimitropoulos
Alan Fung
Enza Gucciardi
Brian Hodges
M Jane Irvine
Jennifer Jones
Adrienne Kovacs
Charmaine Lok
Gail McVey
I Gary Naglie
Marion Olmsted
Rima Styra
George Tomlinson
Alice Wei
D Blake Woodside

Clinical Researchers

Howard Abrams
Mostafa Atri
Michael Baker
Joanne Bargman
W Scott Beattie
Ivan Blasutig
Vera Bril
Joseph Cafazzo
Douglas Cameron
Christopher Chan
Charles Chan
Hance Clarke
Sean Clarke
Edward Cole
Richard Cooper
Robert Cusimano
Paul Daly
Tirone David
Diego Delgado
Eleftherios Diamandis
George Djaiani
Adam Dubrowski
Vladimir Dzavik
Michael Farkouh
Ludwik Fedorko
Christopher Feindel
Scott Fung
Michael Gardam
Sangeet Ghai
Shiphra Ginsburg
John Granton
Sophie Grigoriadis
Flavio Habal
Michelle Hladunewich
Eric Horlick
Susy Hota
Joan Ivanov
S Vanita Jassal
Michael Jewett
K Wayne Johnston
Hans Katzberg
Sidney Kennedy
Edward Keystone
Tae Kim
S Joseph Kim
Simon Kitto
Ayelet Kuper
Leslie Lilly
Christine Maheu
Stuart McCluskey
Massimiliano Meineri
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Michael Sole
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Alice Tseng
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Marcin Wasowicz
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Stephen Wolman
Pui-Yuen Wong
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Douglas Wooster
Robert Wu

Toronto Rehab Institute

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Team Leaders T Douglas Bradley, Tilak Dutta, Robin Green, Susan Jaglal, Avril Mansfield, Katherine McGilton, William McIlroy, Alex Mihailidis, Paul Oh, Milos Popovic, Yana Yunusova
Sub-Committee Chairs Catriona Steele, Katherine McGilton
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Trainee Representatives Alexandra Arnold-Oatley, Jennifer Tomaszczyk
Clinical Liaison Mark Bayley
Liaisons Susan Rappolt, Elizabeth Rochon
Vice President, Research Christopher Paige

Research Snapshot

Research Space	59,696 sq. ft.
External Funding	$8,873,110
Publications	371
Senior Scientists	19
Scientists	22
Adjunct Scientists	78
Total Researchers	119
Fellows	45
Graduate Students	129
Total Trainees	174
Total Staff	106

Researchers

Artificial Intelligence & Robotics

Senior Scientist
Alex Mihailidis

Scientist
Babak Taati

Adjunct Scientists
Sven Dickinson
David Fleet
Deborah Hébert
Jesse Hoey
Dana Kulić
James Little
Alan Mackworth
Goldie Nejat
Pascal Poupart
Rosemary Ricciardelli

Cardiorespiratory Fitness

Senior Scientist
David Alter

Scientists
Tracey Colella
Paul Oh

Adjunct Scientists
Sherry Grace
Krista Lanctôt

Cognition

Senior Scientists
Angela Colantonio
Robin Green

Scientists
Mark Bayley
Nora Cullen
Mary Stergiou-Kita

Adjunct Scientists
Nicole Anderson
Deirdre Dawson
Michelle Keightley
Brian Levine
Doug Richards
Jennifer Steeves

Communication

Senior Scientist
Elizabeth Rochon

Scientist
Frank Rudzicz

Adjunct Scientists
Sonya Allin
Melanie Baljko
Boaz Ben-David
Craig Chambers
Tom Chau
Petros Faloutsos
Julie Mendelson
Aravind Namasivayam
M Kathleen Pichora-Fuller
Frank Russo
Alexander Shaw
Fraser Shein
Gurjit Singh
Pascal van Lieshout
Willy Wong
Yana Yunusova

Mobility

Senior Scientists
Dina Brooks
Brian Maki
William McIlroy

Scientists
William Gage
Avril Mansfield
Kara Patterson

Adjunct Scientists
Shaun Boe
Alastair Flint
Mary Fox
Andrea Iaboni
Cliff Klein
Andrew Laing
Laura Middleton
George Mochizuki
Stephen Perry
James Pratt
W Richard Staines
Karl Zabjek
John Zettel

Neural Engineering & Therapeutics

Senior Scientists
Milos Popovic
Molly Verrier

Scientists
B Catharine Craven
Kei Masani
Jose Zariffa

Adjunct Scientists
Sandra Black
Heather Carnahan
Julio Furlan
Gary Gerber
Lora Giangregorio
Pamela Houghton
Joel Katz
Kristiina McConville
Mary Nagai
Ethne Nussbaum
Linda Rapson
Ze'ev Seltzer
John Shepherd
Timothy Welsh
Paul Yoo

Optimize

Senior Scientists
Cheryl Cott
Susan Jaglal
Pia Kontos
Katherine McGilton
I Gary Naglie
Susan Rappolt

Scientists
Shabbir Alibhai
Walter Wodchis

Adjunct Scientists
G Ross Baker
Jill Cameron
Michel Landry
Nizar Mahomed
Denise Reid
Nancy Salbach

Sleep & Upper Airway

Senior Scientists
T Douglas Bradley
Catriona Steele

Scientist
Hisham Alshaer

Adjunct Scientists
Jan Angus
Jack Goodman
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

Adjunct Scientists
Veronique Boscart
Karen Gordon
Matthew Muller
Donald Philip
Veronica Wadey

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Division Head, Fundamental Neurobiology Peter Carlen
Division Head, Genetics & Development James Eubanks
Division Head, Health Care & Outcomes Research Elizabeth Badley
Division Head, Vision Science Valerie Wallace
Clinical Representative, Krembil Neuroscience Program Michael Fehlings
Clinical Representative, Musculoskeletal Health & Arthritis Program Robert Inman
Clinical Representative, Musculoskeletal Program Nizar Mahomed
Chair, Trainee Affairs Committee Frances Skinner
Senior Director, Finance Peggy McGill
Vice President, TWH Katherine Sabo
Vice President, Research Christopher Paige

Research Snapshot

Research Space	105,154 sq. ft.
External Funding	$35,216,244
Publications	609
Emeritus	2
Senior Scientists	39
Scientists	11
Affiliate Scientists	18
Clinical Researchers	89
Total Researchers	159
Fellows	138
Graduate Students	158
Total Trainees	296
Total Staff	243

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

Emeritus
Charles Tator

Senior Scientists
Cathy Barr
James Eubanks
Michael Fehlings
Robert Inman
Jan Jongstra
Philippe Monnier
Lyanne Schlichter
Elise Stanley
Florence Tsui
Joan Wither

Scientists
W Mark Erwin
Lorraine Kalia
Suneil Kalia

Affiliate Scientist
Nigil Haroon

Health Care & Outcomes Research

Emeritus
Murray Urowitz

Senior Scientists
Elizabeth Badley
J David Cassidy
Aileen Davis
Monique Gignac
Dafna Gladman
Nizar Mahomed

Affiliate Scientists
Cheryl Cott
Paul Fortin
Rosemary Martino

Patient Based Clinical Research

Senior Scientists
Anthony Lang
Colin Shapiro

Scientists
Mark Bernstein
Niall Ferguson
Susan Tarlo

Vector Core

Senior Scientist
Jeffrey Medin

Vision Science

Senior Scientists
John Flanagan
James Sharpe
Martin Steinbach
Graham Trope
Agnes Wong
Valerie Wallace

Scientists
Christopher Hudson
Jeremy Sivak

Affiliate Scientists
Helen Dimaras
Moshe Eizenman
Brenda Gallie
Elizabeth Irving
Frances Wilkinson

Clinical Researchers

Dimitrios Anastakis
Danielle Andrade
Jeff Bloom
Arthur Bookman
Michael Brent
Yvonne Buys
Simon Carette
Leanne Casaubon
Rodrigo Cavalcanti
Vincent Chan
Vinod Chandran
Kenneth Chapman
Ki Jinn Chin
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Maria Cino
Paula Cripps-McMartin
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Miller, Naomi
Razak, Albiruni
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Plastino, Jerry
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Boaro, Nancy
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Brooks, Dina
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Colella, Tracey
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Fancott, Carol
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Gorski, Susan
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Katirai, Shadi
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Masani, Kei
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Nixon, Stephanie
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Patel, Archna
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Sasaki, Karen
Snaiderman, Abraham
Steele, Catriona
Stokely, Shauna
Terzian, Yervant
van Wyk, Paula
Vena, Daniel
Verrier, Molly
Wang, Rosalie
Waxman, Rosalind
Wylie, Lesley
Yap, Audrey

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Hakem, Razqallah
Lemieux, Camille
McDermott, Ian (Ex-Officio)
Medin, Jeffrey
Moloo, Badru (Ex-Officio)
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McPherson, Carley
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Moloo, Badru
Paige, Christopher
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Shannon, John
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Ward, Lois

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Husain, Mansoor
Liu, Mingyao
Paige, Christopher
Rodin, Gary
Urbach, David
Waddell, Thomas (Chair)

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Rönnberg, Jerker
Steeves, John

TRI Peer Review Committee
Green, Robin
Mendelson, Julie
Mihailidis, Alex
Steele, Catriona
Ward, Lois
Wodchis, Walter

TRI Standard Operating Procedures Committee
Campos, Jennifer
Green, Robin
Kuipers, Meredith
McGilton, Katherine (Chair)
Samitov, Anna
Ward, Lois

TRI Team Leaders Committee
Bradley, T Douglas
Chen, Amy (Ex-Officio)
Dutta, Tilak
Fernie, Geoff (Chair)
Green, Robin
Jaglal, Susan
Mansfield, Avril
McGilton, Katherine
McIlroy, William
Mihailidis, Alex
Oh, Paul
Popovic, Milos
Ward, Lois (Ex-Officio)
Yunusova, Yana

TWRI Appointments Committee
Badley, Elizabeth
Carlen, Peter
Davis, Karen
Eubanks, James
Lozano, Andres (Chair)
Wallace, Valerie
Weaver, Donald

TWRI Space Committee
Chen, Robert
Eubanks, James (Chair)
Gignac, Monique
McDermott, Ian
McPherson, Carley
Steinbach, Martin
Vidic, Frank
Wither, Joan

TWRI Trainee Affairs Committee
Adleman, Alanna
Alavi, Mahan
Baglaenko, Yuriy
Christopher, Leigh
DeSouza, Danielle
Hutchison, William
Keiski, Carrie-Lynn
Khuu, Lee-Anne
Koshimori, Yuko
Kucyi, Aaron
Lucero, Ava
McPherson, Carley
Pollock, Remy
Rozanski, Gabriela
Ruff, Crystal
Skinner, Frances (Chair)
Vasudeva, Manoj
Wan, Julie
Wang, Gang
Wither, Joan

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Allon Therapeutics
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Alzheimer Society of Canada
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American Association of Neurological Surgeons
American College of Radiology Imaging Network
American Foundation for Surgery of the Hand
American Society of Clinical Oncology
American Society of Nephrology
American Society of Regional Anesthesia and Pain Medicine
American Society of Transplant Surgeons
American Society of Transplantation
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AOSpine International
apceth
ARIAD Pharmaceuticals
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Association for International Cancer Research
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Bristol-Myers Squibb
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Canada Foundation for Innovation
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Canadian Anesthesiologists' Society
Canadian Association of Gastroenterology
Canadian Association of Radiation Oncology
Canadian Blood Services
Canadian Breast Cancer Foundation
Canadian Cancer Society Research Institute
Canadian Diabetes Association
Canadian Foundation for AIDS Research
Canadian Foundation on Fetal Alcohol Research
Canadian Gene Cure Foundation
Canadian Health Services Research Foundation
Canadian HIV Trials Network
Canadian Initiative for Outcomes in Rheumatology cAre
Canadian Institutes of Health Research
Canadian Liver Foundation
Canadian Lung Association
Canadian National Institute for the Blind
Canadian Pain Society
Canadian Partnership Against Cancer
Canadian Psychological Association
Canadian Pulmonary Fibrosis Foundation
Canadian Radiation Oncology Foundation
Canadian Rheumatology Association
Canadian Society of Plastic Surgeons
Canadian Stroke Consortium
Canadian Stroke Network
Canadian Urologic Oncology Group
Canadian Urology Association
Cancer Care Ontario
Cancer Research Society
Capital District Health Authority
Cardiac Care Network
Caris Life Sciences
Celgene
Centocor Ortho Biotech
Centre Hospitalier de l'Université de Montréal
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Christopher and Dana Reeve Foundation
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Cook Group
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Covance Canada
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CReATe Cord Blood Bank
CSL Behring
Cystic Fibrosis Canada
DLVR Therapeutics
Douglas Mental Health University Institute
Duke University
Dystonia Medical Research Foundation
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Elekta
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Endo Pharmaceuticals
Estate of Ilonka Seder Szabolcsi
Exelixis
Ferring
Fio Corporation
Foundation Fighting Blindness
Fred Hutchinson Cancer Research Center
GE Healthcare
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Genome Canada
GenomeDx Biosciences
Genzyme Canada
Gilead Sciences
Glaucoma Research Society of Canada
GlaxoSmithKline
Grand Challenges Canada
Grifols Therapeutics
Hamilton Health Sciences
Hauptman-Woodward Medical Research Institute
Health Resources in Action
Heart & Stroke Foundation
HemaQuest Pharmaceuticals
Henry Ford Health System
Hoffmann-La Roche Canada
Holland Bloorview Kids Rehabilitation Hospital
Hospira
Hospital for Sick Children
Human Frontier Science Program
Hypertension Canada
Ikaria Therapeutics
Immune Diagnostics & Research
Immunex
INC Research
Informa
InSightec
Institut Universitaire de Cardiologie et de Pneumologie de Québec
Intercept Pharmaceuticals
International Development Research Centre
International Science and Technology Partnerships

Canada
International Society for Peritoneal Dialysis
Janssen
John Wiley and Sons
Johns Hopkins University
Johnson & Johnson
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Kidney Cancer Canada
Kidney Foundation of Canada
Krembil Foundation
Lady Tata Memorial Trust
Lawson Health Research Institute
Leukemia & Lymphoma Society
Liddy Shriver Sarcoma Initiative
Lundbeck Canada
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Massachusetts General Hospital
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Medical Council of Canada
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Merck
Merrimack Pharmaceuticals
Michael J. Fox Foundation for Parkinson's Research
Millenium Pharmaceuticals
Ministry of Health and Long-Term Care
Ministry of Labour
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Mitacs
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Montreal Heart Institute
Mount Sinai Hospital
Mount Sinai School of Medicine
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MultiCell Technologies
Multidata Systems
Multiple Myeloma Research Consortium
Multiple Myeloma Research Foundation
Multiple Sclerosis Society of Canada
Myocarditis Foundation
National Alliance for Research on Schizophrenia and Depression
National Institutes of Health
National Parkinson Foundation
National Sanitarium Association
Nestec
NeuroDevNet
North American Spine Society
Novartis
Novo Nordisk
Ohio State University Research Foundation
Olympus
Oncology Nursing Society
Ontario Brain Institute
Ontario Clinical Oncology Group
Ontario HIV Treatment Network
Ontario Institute for Cancer Research
Ontario Lung Association
Ontario Mental Health Foundation
Ontario Neurotrauma Foundation
Ontario Stroke Network
Ontario Thoracic Society
Onyx Pharmaceuticals
OSI Pharmaceuticals
Otsuka Canada Pharmaceutical
Ottawa Health Research Institute
Oxford Immunotec
Pan American Health Organization
Parexel
Parkinson Society Canada
Partners HealthCare
Pfizer
Pharmaceutical Product Development
Pharmaceutical Research Association
PharmaNet
Phonak
Phytopharm
Prostate Cancer Canada
Proteolix
Providence Health Care
PSI Foundation
Public Health Agency of Canada
Queen's University
Questcor Pharmaceuticals
Quintiles
Radiological Society of North America
Research Institute of the McGill University Health Centre
Respironics
Rick Hansen Foundation
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Roche Organ Transplantation Research Foundation
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Sarcoma Cancer Foundation of Canada
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Sentinelle Medical
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Spectrum Pharmaceuticals
Spina Bifida and Hydrocephalus Association Canada
St. Joseph's Health Centre
St. Michael's Hospital
Stanford University
State University of New York
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The Arthritis Society
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Wake Forest University
Wings for Life Spinal Cord Research Foundation
Women's College Hospital
Workplace Safety and Insurance Board
Wyeth Canada
YM Biosciences
York University

Financials

UHN Foundations
$10,820,000

Investment Income
$3,260,000

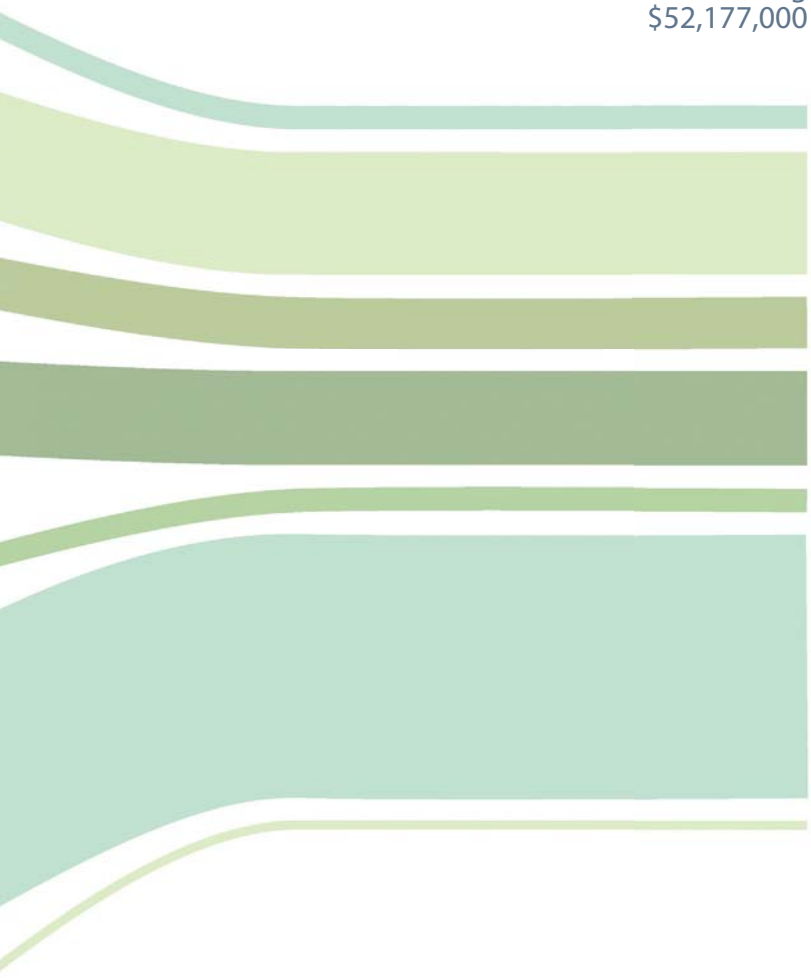
Indirect/Operating Grant Funds
$10,016,000

Rental Income
$5,467,000

Other (including ancillary revenues)
$15,607,000

Ministry of Health & Long-Term Care
$7,007,000

Total Core Research Funding
$52,177,000



Career/Traineeship Awards
$10,558,097

UHN Foundations
$56,000,127

Clinical Studies
$29,389,507

Infrastructure/Maintenance Awards
$46,031,622

Corporate Contracts
$10,056,665

Operating Grants
$125,147,126

Other
$3,855,809

Total External Project Funding
$281,038,953

International Research Advisory Board

Disclaimers

Publication, Personnel and Leadership: Data provided by UHN Research Program Planning & Analysis. Data are accurate as of September 30, 2013. Some figures may be rounded and/or may include data not represented in Institute data. Publications jointly authored by investigators at multiple UHN Institutes are counted only once in the UHN Research total. Researchers with more than one affiliation within an Institute, or between Institutes, are only included once in the total count. Dr. James Sharpe, Senior Scientist at TWRI, passed away November 12, 2013.

Trainee and Research Committees: Data are current as of June 30th, 2013. The Institute trainee counts reflect only those trainees supervised by researchers with a primary appointment at the Institute.

Space: Data provided by UHN Research Facilities Planning and Safety. Data accurate as of September 30, 2013 based on audited research space across UHN campuses. Core facilities space not included in Institute space totals. Please note that space not audited by September 30, 2013 are not included in these totals.

Financial Data: All figures represent fiscal year 2012/13 (ending March 31, 2013) and include the Ontario Cancer Institute (Princess Margaret Cancer Centre), Toronto General Research Institute (Toronto General Hospital), Toronto Western Research Institute (Toronto Western Hospital), Toronto Rehabilitation Institute (Toronto Rehab), Techna Institute and the Toronto Medical Discovery Tower (TMDT). Figures have been provided by UHN Research Financial Services. Figures may not sum due to rounding. The figures presented on page 55 have not been audited. However, they have been included in the overall UHN statements and have been subjected to audit procedures deemed appropriate by auditors in order to determine their overall reasonableness. Total funding includes External and Core Funding amounts and is listed within the UHN Research Snapshot on the inside front cover. Image on pages 54-55: Please note that the infographic is for visual representation only. Line widths are proportional to the corresponding funding amounts in each group. Different funding sources are represented by varying line colours.

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