

# Toronto's Discovery District

INNOVATION, TECHNOLOGY, BUSINESS



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# Toronto's Discovery District Where Research and Business Meet

Health care is one of the fastest-growing economic sectors in the world. Toronto has one of the largest medical and biotech clusters of any metropolitan area in North America.

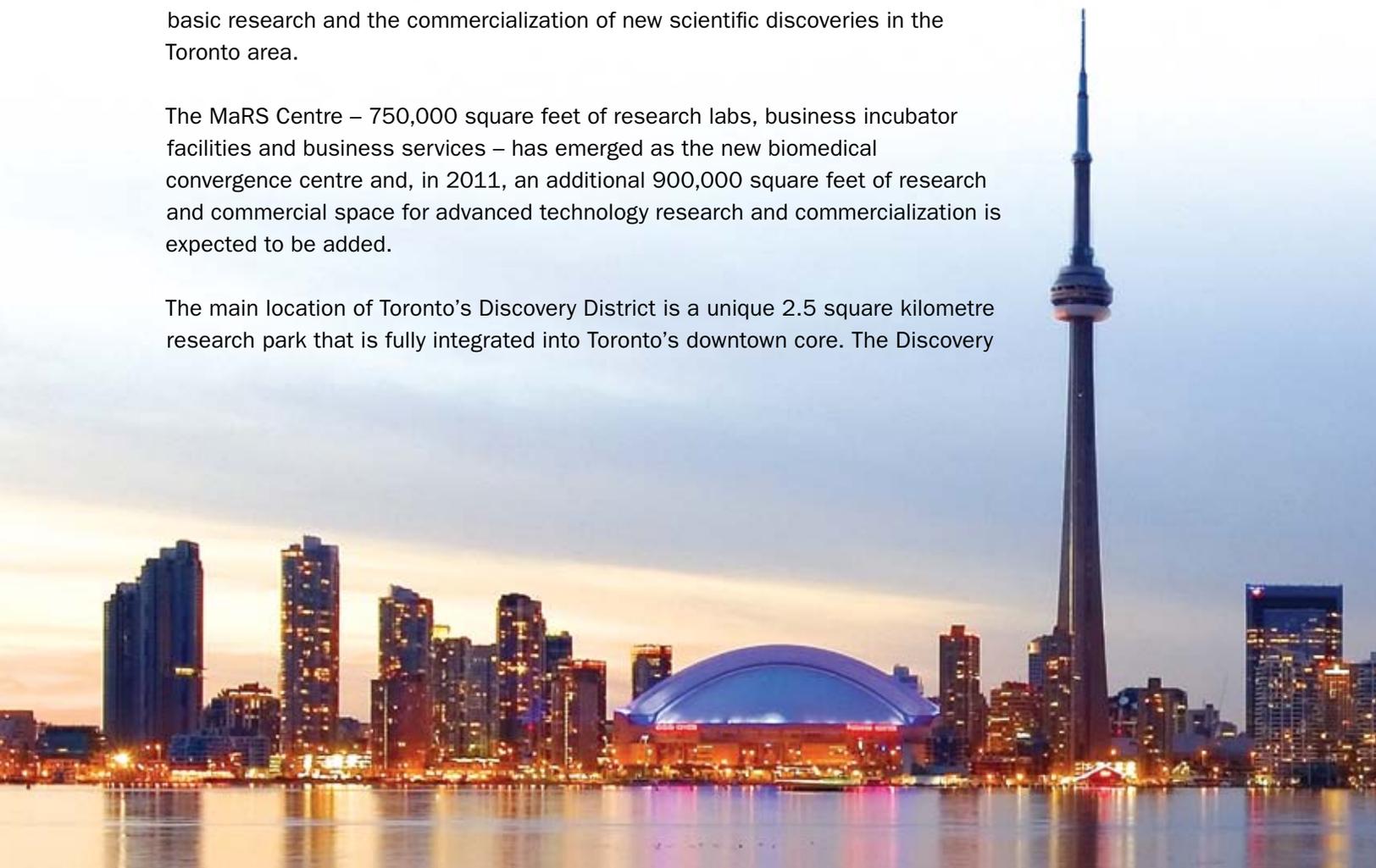
More than \$1 billion is directed annually to research activities in the city's aptly named Discovery District, a global centre of groundbreaking research in bioinformatics as well as new diagnostic and therapeutic tools for every imaginable disease. Discovery District researchers have a world-class reputation for breakthroughs ranging from breast cancer and cardiovascular disease to Alzheimer's and cystic fibrosis.

The biomedical cluster's growth has been dramatic in recent years, and all indications are that this rapid pace will continue into the future. In total, the biomedical industry in Toronto has over 700 companies providing jobs for more than 80,000 people.

The Discovery District continues to grow and to attract investment. More than \$500 million has recently been invested in new infrastructure that will support basic research and the commercialization of new scientific discoveries in the Toronto area.

The MaRS Centre – 750,000 square feet of research labs, business incubator facilities and business services – has emerged as the new biomedical convergence centre and, in 2011, an additional 900,000 square feet of research and commercial space for advanced technology research and commercialization is expected to be added.

The main location of Toronto's Discovery District is a unique 2.5 square kilometre research park that is fully integrated into Toronto's downtown core. The Discovery



District is probably the most concentrated mix of research, biomedical companies, and finance and business support services anywhere in the world.

The centrepiece is the University of Toronto, and its affiliated teaching and research hospitals. The University of Toronto is ranked in the top three North American institutions for medical publications and citations – a measure of medical science impact. Three additional nodes of the Discovery District, also in Toronto's downtown core, exist where a concentration of medical research activity is found. Close by is Bay Street – Canada's financial and business centre – with legal, accounting and venture capital investment experts. These advisors are well versed in the unique requirements of medical and biotechnology matters. One block away is the seat of the Ontario government.

Very close by is the new Donnelly Centre for Cellular and Bio-Molecular Research, a multi-storey, \$110 million research centre and the new Leslie Dan Faculty of Pharmacy. These are part of a series of major capital investments that will house a new generation of biomedical researchers and continue to keep Toronto at the forefront of biomedical excellence for decades to come.

Toronto's Discovery District is more than just world-class science and discovery. It is working hard to take that new knowledge and create new opportunities for business. Contact Toronto Economic Development for access to any one of the institutions profiled in this brochure and find out how you can benefit commercially from the innovative technologies that can be found in Toronto.

Toronto Economic Development is ready to help. The expert team of specialists can answer all of your questions about business and investment opportunities in our community. Toronto Economic Development also offers an in-depth biomedical cluster profile and liaison with other government agencies and with industry.

**For more information contact:**

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Toronto Economic Development  
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mbuist@toronto.ca  
[www.toronto.ca/business](http://www.toronto.ca/business)



# Toronto's Discovery District Innovation, Technology and Business

Toronto's renowned life science industry started nearly a century ago with the discovery and development of a vaccine that protected the world against diphtheria. Furthered by vision, scientific talent and a determination to succeed, and coupled with a strong entrepreneurial thrust, Toronto's researchers have been producing breakthrough discoveries ever since.

Toronto is also where insulin was discovered and produced for the world's benefit. It is here that stem cells were discovered and where the genes responsible for many diseases that affect us as humans were identified; diseases such as breast cancer, cystic fibrosis, Alzheimer's and Duchenne muscular dystrophy ... to name but a few. Toronto is also where the world's first nerve transplant and the first double lung transplant were performed and where the T-cell receptor gene was identified that provided a major advance in the world's understanding of the human immune system.



Toronto's life science sector has enjoyed a very impressive past and is driving forward to an even more impressive future. Clearly, Toronto is poised to meet global pharmaceutical challenges with a vibrant and dynamic research and development community.

But Toronto is not just about engaging in early stage research. Innovative discoveries from our research institutions are creating new companies where these technologies are being developed and commercialized into new products and services. Centred in Toronto's aptly named Discovery District is MaRS. Currently a 750,000 square foot facility dedicated to the development and commercialization of innovative technologies, MaRS is expanding with a second phase which will provide almost 900,000 additional square feet of commercialization space. MaRS however, is not alone in expanding research infrastructure. Many of Toronto's teaching hospitals and research institutions are also building and expanding new facilities for R&D that together provide for an investment of over \$1.2 billion.

These new and improved R&D centres will help to retain and attract scientists from around the world as well as solidify Toronto's position as the third largest pharmaceutical and life science cluster in North America – with more than 700 companies providing jobs for more than 150,000 people. With eight universities and colleges, nine teaching hospitals and numerous private sector research facilities, Toronto offers a wide range of research and business development opportunities.

The Toronto area is home to large multi-national medical companies. Many of the most important pharmaceutical and biotech companies are already located here. Among them are Sanofi Pasteur, Eli Lilly, Bayer, GlaxoSmithKline Inc., AstraZeneca, Apotex, and Teva Canada.

Our biopharmaceutical industry and health research community is not only a source of scientific discovery, but is also producing innovative new technologies and products that are vital to the health and well-being of people from all over the world.

Toronto is at the core of one of the fastest growing economic regions in North America. It has nurtured a broad range of economic clusters that characterize a global city. Toronto has unique assets: its residents, a diverse creative, talented and well educated labour pool and a value system that embraces ideas and people from all over the world. Our location in North America provides for global connectedness. These attributes combined with a renowned health care system, a world-class research community and our reputation as an extremely liveable city give Toronto an immense competitive advantage in today's knowledge and innovation driven economy.

For more information on Toronto's dynamic life science community or to request a detailed list of scientific "world's firsts," or a business guide to Toronto's Discovery District, please contact Matt Buist, Toronto Economic Development at 416-392-3380 or [mbuist@toronto.ca](mailto:mbuist@toronto.ca).

**[www.toronto.ca/business](http://www.toronto.ca/business)**

# Toronto's Discovery District Quick Facts

Toronto's Discovery District is more than just world-class science and discovery. The research park which is fully integrated into Toronto's downtown core offers a concentrated mix of research, biomedical companies, finance and business support services for the research community, and more.

- 2 square kilometres of concentrated brain power
- More than 50,000 jobs
- 22,000+ medical care and research-related jobs
- 9 teaching hospitals
- 30+ specialized medical and related sciences research centres

## University of Toronto

- Over 70,000 students
- Canada's largest university
- 11th of the rankings of HEEACT that measures the performance of scientific papers for world universities (2009)
- 11th in the world in Life Sciences and Biomedicine ranked by Times Higher Education's QS World University Rankings (2009)
- One of the largest Faculties of Medicine in North America
- More medical faculty and students than Harvard
- Ranked 4th in North American in terms of medical research spending

## York University

- 50,000 students
- 3rd largest university in Canada
- leading interdisciplinary research and teaching university in Canada

## Ryerson University

- Canada's leader for innovative career-focused education
- 28,000 undergraduate and graduate students
- largest primarily undergraduate university in Canada

## Biotechnology specialization in:

- vaccines
- diagnostics
- Bio-informatics
- Bio-pharmaceuticals
- Biotech instrumentation
- Genomic, proteomics

**1930:** Frederick Tisdall, Theodore Drake and Alan Brown of the Faculty of Medicine announce the creation of the infant cereal, "Pablum".

– University of Toronto, Faculty of Medicine

# Frequently Asked Questions

## What is Toronto's Discovery District?

Toronto's Discovery District is a partnership of government, academic, and healthcare institutions coming together to form an integrated research environment, serving Canada's and the world's bio-medical discovery community. Toronto's Discovery District is responsible for over \$1 billion of research annually, taking research and innovation from bench to bedside, from concept to final product.

## How are the technology transfer and commercialization offices of Toronto's Discovery District organized?

Technology arising from Toronto's Discovery District can be accessed from the technology transfer offices of the member institutions. Contact information can be found on the individual profiles of the Discovery District members contained herein.

## What are some of the success stories of the Discovery District? Start-up ventures? Licenses? Sponsored research with industry?

Member institutions have worked with industry partners in everything from early-stage and pre-clinical research collaborations, up to and including human Phase III clinical trials. Toronto's research community has a long history of "firsts", including anti-rabies vaccines, the heart pacemaker and "Pabulum", the first scientifically designed baby food. More recent breakthroughs include the isolation of T-Cell and Dopamine receptors, and isolating genes for muscular dystrophy, cystic fibrosis, Alzheimer's disease and breast cancer. Footnotes on each page identify some additional breakthrough discoveries. For a detailed list of Toronto's world firsts contact Matt Buist at the City of Toronto ([mbuist@toronto.ca](mailto:mbuist@toronto.ca)).

## What are the opportunities and services provided?

In-licensing/ out-licensing and service opportunities abound. Please see the profile pages of member institutions for the services provided to industry.

## What incentive programs are available to support the development of a vibrant biotechnology industry and help reduce research costs?

Thanks to federal and provincial tax credit programs, conducting research within Toronto's Discovery District can reduce research costs by up to 66%. Speak with any Discovery District member institution representative and find out how partnering within Toronto's Discovery District can help you.

**1961:** James E. Till and Ernest A. McCulloch discover the hemopoietic stem cell. This is the basis for bone marrow transplantation, which is a highly successful clinical story today.

– University of Toronto, Faculty of Medicine

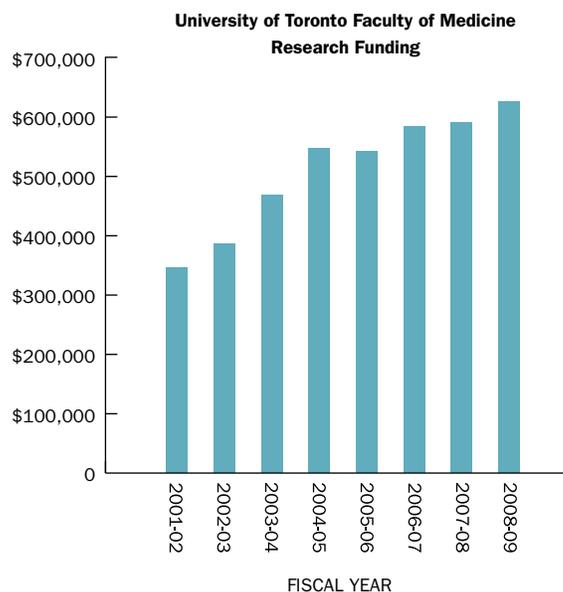
# Toronto's Discovery District Research Advantages

The centrepiece of Toronto's Discovery District is the University of Toronto (U of T).

U of T is Canada's leading research-intensive university and one of the largest of its kind in North America.

The University's Faculty of Medicine boasts a total academic faculty of 5,822. Enrolment in Faculty of Medicine disciplines totalled over 30,400 for the 2009-2010 academic calendar.

There are 10 hospitals and their respective research institutes fully affiliated with the University of Toronto as well as 19 community-affiliated hospitals and related facilities.



## Research and technology commercialization are supported by significant financial incentives

Ontario, in partnership with the Government of Canada, offers a world-leading tax credit system for research and development. When tax credits are factored in, the after-tax cost of \$100 in R&D spending can be reduced to less than \$36. Some of the many incentives include:

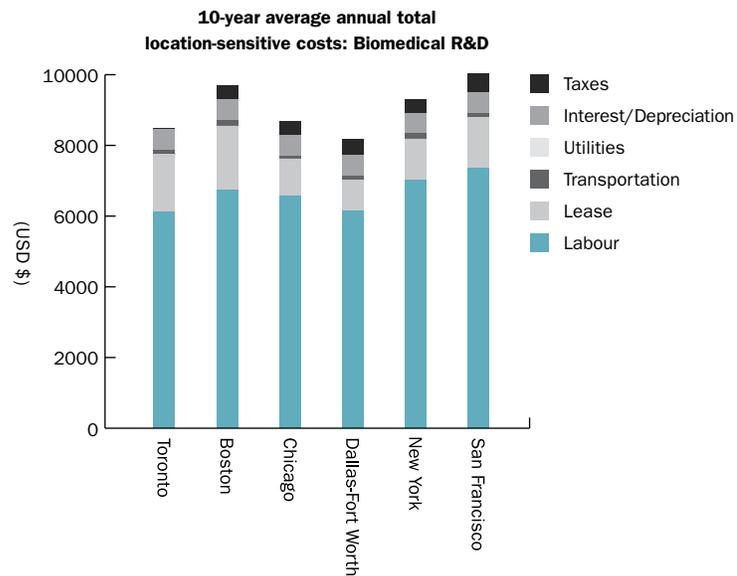
- The Scientific Research and Experimental Development (SR&ED) program is the largest single source of federal government support for industrial research and development tax credits. Generally, a Canadian-controlled private corporation can earn an investment tax credit of 35% up to the first \$3 million of qualified expenditures for SR&ED carried out in Canada.

**2009:** Dr. Andras Nagy reports a new method of creating stem cells that could lead to possible cures for devastating diseases including spinal cord injury, macular degeneration, diabetes and Parkinson's disease.

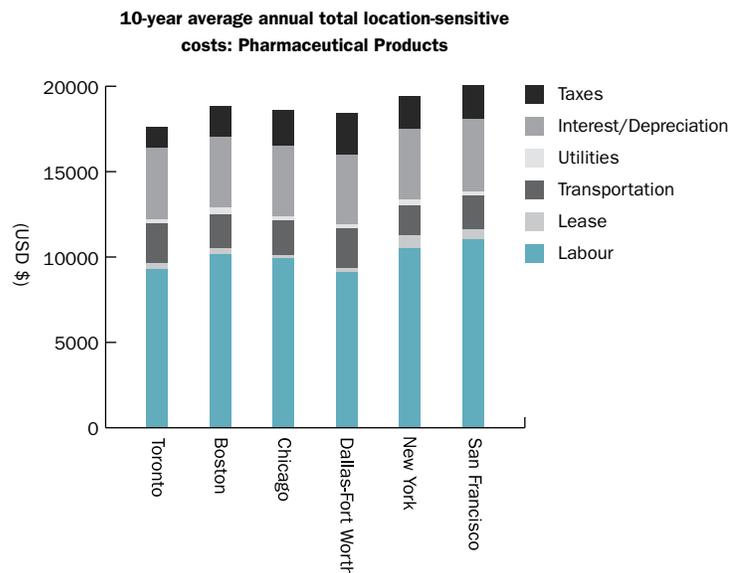
– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

- The Ontario Business-Research Institute Tax Credit is a 20 per cent refundable tax credit for corporations incurring expenditures under a contract with an eligible research institute.
- The Ontario Innovation Tax Credit is a 10% refundable tax credit for SR&ED expenditures. Qualifying SR&ED expenditures include 100% of current expenses and 40% of capital expenditures.

## Toronto offers a very cost competitive environment for research and investment



Source: KPMG Competitive Alternatives 2010  
Based on lease of a 45,000-sq. ft. facility



Source: KPMG Competitive Alternatives 2010  
Based on 70,000-sq. ft. built factory

**1973:** Canada's first transplant operation where a kidney from a living donor was given to a child took place at HSC.

– The Hospital for Sick Children

# Profiles of Toronto's leading research facilities

RESEARCH INSTITUTE	Baycrest	CAMH
<b>RESEARCH AREAS</b>	<p><b>Cognitive Neuroscience:</b></p> <ul style="list-style-type: none"> <li>- memory &amp; attention</li> <li>- mood &amp; emotion processing</li> <li>- language &amp; auditory perception</li> <li>- cognitive development &amp; aging</li> <li>- cognitive rehabilitation</li> <li>- genetic &amp; epigenetic influences on cognition</li> <li>- neural network imaging &amp; computational modeling</li> </ul> <p><b>Clinical &amp; Applied Research:</b></p> <ul style="list-style-type: none"> <li>- mood disorders &amp; mental health in aging</li> <li>- Alzheimer's and other dementias, stroke, MCI, TBI, FTD, VCI</li> <li>- metabolism and cognition</li> <li>- cognitive training</li> <li>- assistive technology &amp; e-support for clients and caregivers</li> <li>- occupational therapy &amp; cognitive rehabilitation</li> <li>- psychosocial aspects of long-term care</li> <li>- neuroinformatics</li> <li>- neuroimaging technology</li> <li>- clinical psychopharmacology</li> </ul>	<p><b>Neuroscience</b></p> <ul style="list-style-type: none"> <li>• Molecular Biology</li> <li>• Biochemistry</li> <li>• Pharmacology</li> <li>• Genetics</li> <li>• Epigenetics &amp; Biobehavioural research</li> <li>• Pharmacogenetics</li> </ul> <p><b>Clinical Research</b></p> <ul style="list-style-type: none"> <li>• Addictions</li> <li>• Child, Youth and Family</li> <li>• Dual Diagnosis</li> <li>• Geriatric Mental Health</li> <li>• Law and Mental Health</li> <li>• Mood and Anxiety Disorders</li> <li>• Schizophrenia</li> </ul> <p><b>Brain Imaging</b></p> <p><b>Social and Epidemiological Research</b></p> <ul style="list-style-type: none"> <li>• Health Services</li> <li>• Interventions</li> <li>• Health Policy</li> </ul>
<b>NO. OF PRINCIPAL RESEARCHERS</b>	32	Over 100
<b>RESEARCH BUDGET</b>	\$19 million annual extramural funding (2010/11)	\$56.2 million (2009-2010)
<b>NO. OF CLINICAL TRIALS</b>	210 active research protocols	N/A
<b>SPECIAL FEATURES</b>	<ul style="list-style-type: none"> <li>- Functional Magnetic Resonance Imaging (fMRI) (on-site)</li> <li>- Magnetoencephalography (MEG) (on-site)</li> <li>- Electroencephalography (EEG) (on-site)</li> <li>- Positron Emission Tomography (PET) (w/ CAMH)</li> <li>- Single-photon computerized tomography (SPECT) (w/ CAMH)</li> <li>- Baycrest Centre for Brain Fitness</li> <li>- Memory Link Program</li> <li>- Toronto Trans-generational Brain and Body Centre (Baycrest and SickKids)</li> </ul>	<p>Positron Emission Tomography (PET) Centre dedicated to mental health and addictions research</p> <p>Epigenetics laboratory</p> <p>Pharmacogenetics clinic</p>

**1908:** Stuart Foster and his team at Sick Kids install the first milk pasteurization plant in Canada, 30 years before it becomes mandatory. This act all but eliminates diseases transmitted by unpasteurized milk like tuberculosis, salmonella, and E.coli. Pasteurization dramatically decreases infant mortality in Canada.

<b>RESEARCH INSTITUTE</b>	<b>The Hospital for Sick Children</b>	<b>St. Michael's Hospital</b>
<b>RESEARCH AREAS</b>	Cell Biology, Child Health Evaluative Sciences, Developmental & Stem Cell Biology, Genetics & Genome Biology, Molecular Structure & Function, Neurosciences & Mental Health and Physiology & Experimental Medicine	Fundamental Mechanisms of Organ Dysfunction, Clinical Research, Inner City Health, Global Health and Knowledge Translation
<b>NO. OF PRINCIPAL RESEARCHERS</b>	More than 2,000	180 researchers, over 400 research staff
<b>RESEARCH BUDGET</b>	Total research funding \$146 million (2008-2009)	approximately \$40 million in external research funding
<b>NO. OF CLINICAL TRIALS</b>	More than 2,900	There are approximately 300 active clinical trials at St. Michael's Hospital which study the determinants and consequences of disease and evaluate the benefits and harms of various interventions.
<b>SPECIAL FEATURES</b>	<ul style="list-style-type: none"> <li>- Advanced Bioimaging Centre (ABC)</li> <li>- Advanced Protein Technology Centre (APTC)</li> <li>- Analytical Facility For Bioactive Molecules</li> <li>- Biostatistics, Design And Analysis Unit (BDA)</li> <li>- Canadian Mouse Mutant Repository (CMMR)</li> <li>- The Centre For Applied Genomics</li> <li>- Centre For Computational Biology (CCB)</li> <li>- Clinical Research Centre</li> <li>- Embryonic Stem Cell (ES) Facility</li> <li>- Flow Cytometry Facility</li> <li>- Focus In Synthetic Chemistry (FISC)</li> <li>- Imaging Facility</li> <li>- Monoclonal Antibody Facility</li> <li>- Research MRI Facility</li> <li>- Signalling Identification Network (SIDNET)</li> <li>- Toronto Centre for Phenogenomics</li> <li>- Transgenic Core (TCP TG CORE)</li> </ul>	St. Michael's Hospital is building the Li Ka Shing Knowledge Institute, the only institute of its kind in North America. The Knowledge Institute, which is scheduled to open in 2011, will marry research and education in a hospital setting in order to best integrate the tripartite priorities of excellence in patient care, research and education. As a 335,000 square foot state-of-the-art facility, the Knowledge Institute will be comprised of two nine-storey centres: the Keenan Research Centre and the Li Ka Shing International Healthcare Education Centre.

#### UNIVERSITY HEALTH NETWORK

<b>RESEARCH INSTITUTE</b>	<b>Ontario Cancer Institute</b>	<b>Toronto General Research Institute</b>	<b>Toronto Western Research Institute</b>
<b>RESEARCH AREAS</b>	Cancer	Cardiology; Transplantation; Immunology and Autoimmunity; Infectious Diseases; Tissue Injury; Diabetes	Neural and Visual Sciences; Musculoskeletal Diseases; Urban and Community Health Programs
<b>NO. OF PRINCIPAL RESEARCHERS</b>	248	184	126
<b>NO. OF TRAINEES</b>	425	231	133
<b>NO. OF SUPPORT STAFF</b>	622	342	203
<b>RESEARCH BUDGET</b>	\$112.8 million external funding (2008-2009)	\$73 million external funding (2008-2009)	\$27.4 million external funding (2008-2009)
<b>NO. OF CLINICAL TRIALS</b>	Up to 1,000		

**2005:** Researchers show that bright artificial light therapy is as effective as, and works faster and produces less agitation than, antidepressant medication in the treatment of winter depression.

– Sunnybrook Health Sciences Centre

<b>RESEARCH INSTITUTE</b>	<b>Sunnybrook</b>	<b>Samuel Lunenfeld</b>
<b>RESEARCH AREAS</b>	Seven strategic research programs: Brain Sciences; Holland Musculoskeletal; Odette Cancer; Schulich Heart; Trauma, Emergency & Critical Care; Women & Babies; and Veterans & Community. Main areas of expertise are in clinical epidemiology and health sciences; clinical integrative biology; imaging; and molecular and cellular biology.	Cancer Genetics; Epidemiology & Biostatistics; Genomic Medicine; Mouse Models of Human Disease; Neurodevelopment; Cognitive Function; Stem Cells/Tissue Engineering; Systems Biology; Women's and Infants' Health.
<b>NO. OF PRINCIPAL RESEARCHERS</b>	209	34
<b>RESEARCH BUDGET</b>	\$62.6 million annual extramural funding (2008–2009)	\$70 million annual extramural funding (2009/2010)
<b>NO. OF CLINICAL TRIALS</b>	1,264 active clinical protocols	230
<b>SPECIAL FEATURES</b>	<p><b>1.5 Tesla research MRI facility</b> www.sunnybrook.ca/research/?page=sri_core_15tmri_home</p> <p><b>3.0 Tesla research MRI facility</b> www.sunnybrook.ca/research/?page=sri_core_3tmri_home</p> <p><b>Antibody facility</b> www.sunnybrook.ca/research/?page=sri_core_antib_home</p> <p><b>Centre for cytometry and scanning microscopy</b> www.sunnybrook.ca/research/?page=sri_core_cyto_home</p> <p><b>Genomics core facility</b> www.sunnybrook.ca/research/?page=sri_core_genom_home</p> <p><b>Murine genotyping facility</b> www.sunnybrook.ca/research/?page=sri_core_genot_home</p> <p><b>Histology facility</b> www.sunnybrook.ca/research/?page=sri_core_histo_home</p> <p><b>Hybridoma facility</b> www.sunnybrook.ca/research/?page=sri_core_hybrid_home</p> <p><b>Proteomics facility</b> www.sunnybrook.ca/research/?page=sri_core_prot_home</p> <p><b>Transgenic facility</b> www.sunnybrook.ca/research/?page=sri_core_tf_home</p> <p><b>Tumour bank</b> www.sunnybrook.ca/research/?page=sri_core_tbank_home</p>	<p>Robotics and High-throughput Screening Facility - This facility assists in the development of chemical and cellular assays for a variety of high-throughput experiments, and gives researchers access to a range of advanced robotic and analysis instrumentation as well as chemical and RNAi libraries. http://robotics.lunenfeld.ca/</p> <p>The Centre for Modeling Human Disease – Mouse models relevant to human disease and screening tools for in-depth analysis of the major physiological systems in the mouse. www.phenogenomics.ca/services/phenotyping.html</p> <p>Biospecimen Repository - Affiliated with Mount Sinai Hospital's Department of Pathology and Laboratory Medicine, storing biological specimens collected through research studies for investigators within and outside the Lunenfeld.</p> <p>Toronto Centre for Phenogenomics - A state-of-the-art facility for the production, housing, and preclinical analysis of genetically altered mice. Within this centre is the Transgenic Core Facility, which includes innovative technologies to create genetically engineered model organisms. www.phenogenomics.ca/</p> <p>Proteomics and Mass Spectrometry - Consists of a variety of mass spectrometers and separation systems and was expanded in 2010. State-of-the-art instrumentation greatly facilitates the identification of small amounts of proteins and their chemical modifications from complex biological samples.</p> <p>Microscopy and Imaging - A variety of fluorescence microscopes (spinning disk, 2-photon, etc.). In addition, there are two Applied Precision Deltavision systems, an OMX structured illumination microscope, and a new, customized 2-photon microscope equipped with lasers that allow for simultaneous visualization and manipulation of a specific protein in real time and in live cells.</p> <p>ES Cell Core - A centralized facility for the handling and manipulation of mouse ES cells. The Core provides the users from Lunenfeld laboratories with quality-controlled ES cells developed at SLRI as well as reagents necessary for the experiments. Currently R1 and G4 ES cells as well as Mouse Embryonic fibroblast (MEF) prepared from TgN (DR4) 1 Jae strain that are resistant to G418, puromycin, hygromycin, and 6-thioguanine are available for use in the facility.</p>

**2008:** Deep brain stimulation—implanting battery-powered electrodes into the brain to deliver electrical signals to the brain—has been primarily used in Parkinson's patients and other movement disorders. Drs. Andres Lozano, Mary Pat McAndrews, Colin Shapiro and Richard Wennberg found increasing electrode stimulator intensity caused memories to become more vivid and detailed.

<b>RESEARCH INSTITUTE</b>	<b>Ryerson University</b>	<b>York University</b>
<b>RESEARCH AREAS</b>	Digital Media, Communication and Information Technology; Energy, Sustainability and the Environment; Health and Well Being; Civil Society and Cultural Prosperity; Technological and Industrial Innovation; Management, Competitiveness and Entrepreneurship; Learning and Teaching Effectiveness	Fundamental Mechanisms of Organ Dysfunction, Clinical Research, Inner City Health, Global Health and Knowledge Translation
<b>NO. OF PRINCIPAL RESEARCHERS</b>	225	Over 1,400
<b>RESEARCH BUDGET</b>	Over \$22 million	Over \$67 million annual extramural funding (2008/09)
<b>NO. OF CLINICAL TRIALS</b>	N/A	N/A
<b>SPECIAL FEATURES</b>	<p>Knowledge creation and dissemination at Ryerson is based on research that is leading edge and innovative, cross-disciplinary, applied, and engaged in global partnerships. Examples of state-of-the art facilities include:</p> <p><b>Digital Media Zone</b> www.ryerson.ca/dmz</p> <p><b>Faculty of Engineering, Architecture and Science</b> www.ryerson.ca/feas</p> <p><b>Aerospace Engineering</b> www.ryerson.ca/aerospace</p> <p><b>Medical Physics</b> www.ryerson.ca/physics</p> <p><b>Architectural Science</b> www.arch.ryerson.ca</p> <p><b>Chemical Engineering</b> www.ryerson.ca/chemeng</p> <p><b>Department of Electrical and Computer Engineering</b> www.ee.ryerson.ca</p> <p><b>Department of Mechanical and Industrial Engineering</b> www.ryerson.ca/mie</p> <p><b>Centre for Food Security</b> www.ryerson.ca/foodsecurity</p> <p><b>Human Factors Engineering Lab</b> www.ryerson.ca/hfe</p> <p><b>Science of Music, Auditory Research and Technology Lab</b> www.ryerson.ca/smart</p> <p><b>Centre for Learning Technologies</b> www.ryerson.ca/clt</p> <p><b>Robotics and Manufacturing Automation Lab</b> www.ryerson.ca/~rmal</p> <p><b>HIV Prevention Lab</b> www.ryerson.ca/thart/lab</p> <p><b>Sleep and Depression Lab</b> www.ryerson.ca/~ccarney</p> <p><b>Diversity Institute in Management and Technology</b> www.ryerson.ca/diversity</p> <p><b>Ryerson Law Research Centre</b> www.ryerson.ca/lawcentre</p>	<p><b>Centre for Atmospheric Chemistry</b> www.cac.yorku.ca/</p> <p><b>Centre for Research in Earth and Space Science</b> www.cress.yorku.ca/</p> <p><b>Centre for Research in Mass Spectrometry</b> www.chem.yorku.ca/CRMS/</p> <p><b>Centre for Research on Biomolecular Interactions</b> skrylov@yorku.ca (Web site is in development)</p> <p><b>Centre for Vision Research</b> http://cvr.yorku.ca/home/</p> <p><b>Geospatial Information and Communication Technology Lab (GeoICT)</b> www.geoict.yorku.ca/</p> <p><b>Institute for Research and Innovation in Sustainability</b> www.iris.yorku.ca</p> <p><b>Las Nubes Centre for Neotropical Conservation and Research</b> www.yorku.ca/lasnubes</p> <p><b>Muscle Health Research Centre</b> www.yorku.ca/mhrc</p> <p><b>York Core Molecular Biology and DNA Sequencing Facility</b> www.yorku.ca/biocore/</p> <p><b>York Institute for Health Research</b> www.yorku.ca/yihr/</p>

**1977:** Developed a technique for Peritoneal Dialysis that made it possible on a large scale.

– Dr. Dimitri Oreopoulos, University Health Network

# Baycrest



Baycrest is driving urgently needed innovation in successful aging and brain health. Located on a 22-acre campus in Toronto, Baycrest is one of the world's leading academic health sciences centres focused on aging. One of the few places in the world to have a world-class research institute embedded within a rich continuum of senior care services, Baycrest continues to attract some of the most influential scientists in aging and cognition and is a laboratory for unparalleled innovation in clinical care delivery to an aging population.



**2005:** A team of bioengineers discovers a way to increase the yield of stem cells from umbilical cord blood, to an extent which could broaden therapeutic use of these cells.

– University of Toronto, Faculty of Medicine

Baycrest's Research Centre for Aging and the Brain includes the acclaimed Rotman Research Institute, a global leader in the field of cognitive neuroscience in aging, and the Kunin-Lunenfeld Applied Research Unit (KLARU), which conducts research alongside clinicians and applies findings directly to patient care. Together the Rotman and KLARU form a continuum of research – from basic science that elucidates the fundamental mechanisms and processes of cognition to translational research that determines how best to implement this knowledge in the context of aging in the real world.

## Baycrest Centre for Brain Fitness

In April 2008, the Ontario Ministry of Research and Innovation awarded \$10 million toward the creation of the Baycrest Centre for Brain Fitness (CBF), matching another \$10 million in private donations. The centre's mandate is to translate and fast-track promising cognitive



assessment and training strategies into practical applications that benefit an aging population. To do this, the centre partnered with Canada's premiere innovation incubator MaRS to engineer and market a suite of scientifically proven brain fitness products that will be the gold standard and consolidate Ontario and Canada's reputation in neuroscience research and innovation.

Baycrest is an ideal environment for incubating new commercial opportunities that address the challenges of the aging brain. Projects at the CBF range from social robotics to cognitive rehabilitation therapies. The researchers and clinicians at Baycrest are continually uncovering new methods for research, diagnosis and treatment of cognitive decline.

## Cogniciti

To commercialize the science-driven interventions coming out of the Baycrest Centre for Brain Fitness for the general population, Baycrest and MaRS created the for-profit company Cogniciti in December 2009. It aims to stake a claim in the nascent brain fitness market which is projected to grow to between one and five billion dollars by 2015. Cogniciti leverages Baycrest's cognitive research strengths and MaRS's expertise in growing and scaling market-driven ventures. The company's first product will be an evidence-based cognitive training program for the workplace, aimed at optimizing the abilities of knowledge workers to reason, remember, learn, plan and adapt. Increased confidence in memory abilities, and cognitive efficiency, will lead to better performance at work.

## Memory Link

Baycrest's innovative Memory Link program blends cutting-edge brain research with emerging electronic technology to train people with

**1991:** Stuart Foster and his team invent and license the world's first high frequency ultrasound micro-imaging scanner for preclinical imaging. This scanner is now used around the world for research applications and clinical imaging of the eye to detect glaucoma and anterior segment tumours.

– Sunnybrook Health Sciences Centre

severe amnesia to use smartphones and other handheld devices as assistive memory aids. The program, delivered by psychologists, uses an evidence-based training method that taps into the client's undamaged procedural memory. Electronic memory prosthetics have the potential to help an aging population with a wide range of memory disorders.

## Computational Neuroscience and Brain Network Dynamics – the world's first virtual brain

Baycrest's Rotman Research Institute is leading a team of international scientists in a mammoth project to create the world's first functional, virtual brain. The effort puts Canada in a global race to pull off a neuroscience feat that is comparable to decoding the human genome. The achievement could revolutionize how clinicians assess and treat various brain disorders, including cognitive impairment caused by stroke and Alzheimer's disease.

## The Toronto Transgenerational Brain and Body Centre

The Rotman Research Institute and the Hospital for Sick Children – two research powerhouses at different ends of the age spectrum – have teamed up to examine how environment and genes shape the human brain and cognition as well as metabolic and cardiovascular disorders from childhood to old age. They've created the Toronto Transgenerational Brain and Body Centre to carry out this massive population science project. It's the first of its kind in North America and will recruit hundreds of multigenerational family members from various ethnic groups, yielding vital data that will inform future interventions toward successful aging.

## Internet intervention for family caregivers

Baycrest has developed an internet-based video conferencing intervention program for dementia caregivers to help them sustain their caregiving tasks without compromising their own health. Supporting the health of the caregiver with electronically delivered educational and psychosocial supports can help delay the costly institutionalization of those with dementia, which translates into substantial savings for the Province.

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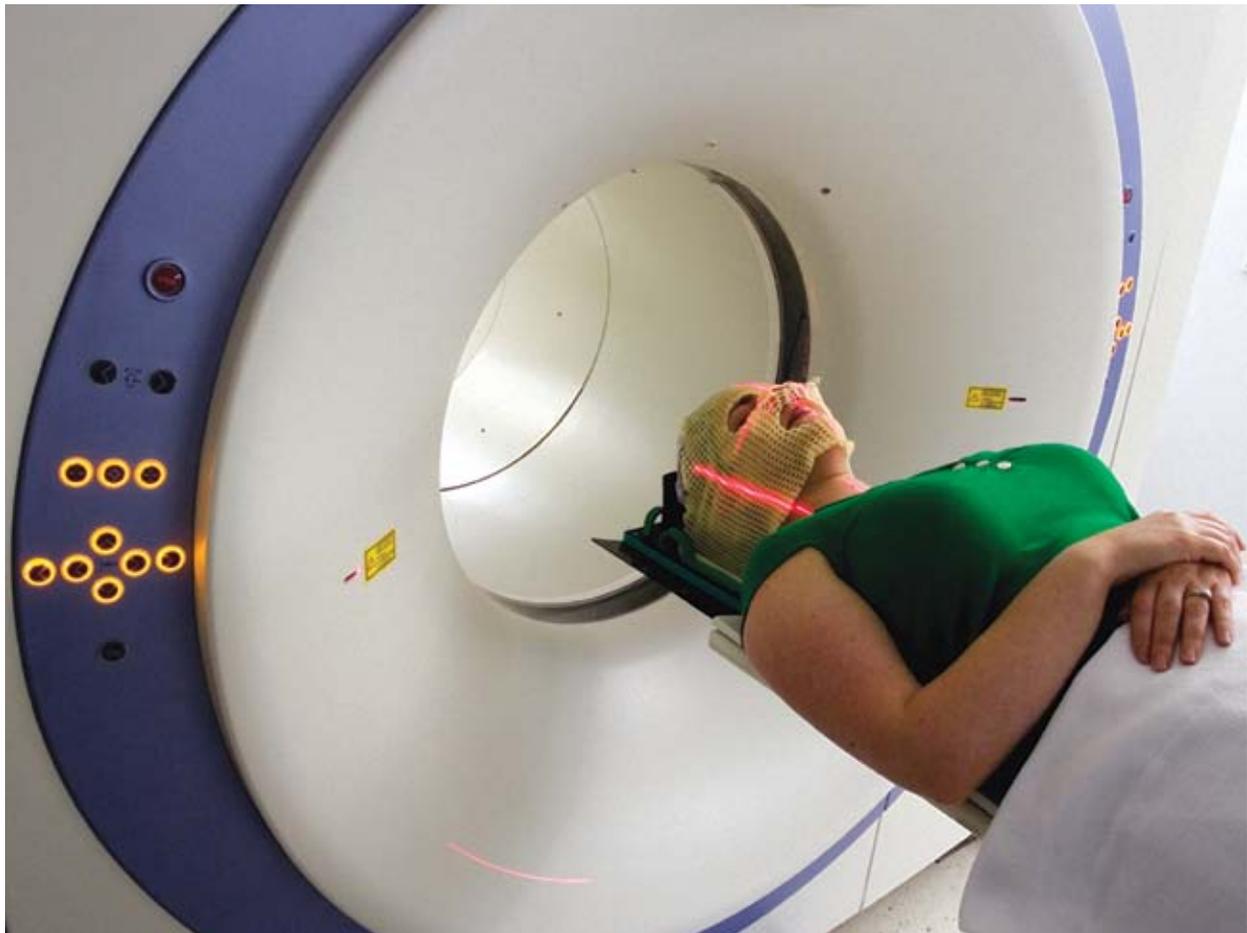
**2006:** The Ontario Ministry of Health and Long-term Care announces funding allowing Sexual Assault Treatment and Care Centres across Ontario to offer HIV prevention drugs to all sexual assault victim/survivors. This program is based on the findings of HIV PEP Study (post-exposure study) a joint project between the Ontario Network of Sexual Assault Treatment and Care Centres and Women's College scientists (Loutfy, Du Mont).

# Centre for Addiction and Mental Health



Centre for Addiction and Mental Health  
Centre de toxicomanie et de santé mentale

The Centre for Addiction and Mental Health (CAMH) serves individuals through hospital and ambulatory care services both in Toronto and across Ontario. It is the largest health care facility in Canada that is dedicated to treating, preventing, and understanding mental illness and addiction.



**2003:** SickKids researchers link maternal folic acid intake to a decrease in nueroblastoma – a deadly childhood cancer.

– The Hospital for Sick Children

Our Research Department is among the top five such programs in the world.

The criteria for research at CAMH includes excellence in science, relevance to CAMH mission, and integration across the research domains. Our scientists are committed to working together through and across disciplines -- “from neurons to neighbourhoods.” We aim for research that catalyzes change in how people receive care.

The CAMH Research Department has about 100 research scientists and approximately 400 staff, plus approximately 45 trainees, 40 post-doctoral students and 105 graduate students. We work closely with the independent CAMH Research Ethics Board.

Most CAMH research is funded externally through top-tier competitive grant awards. Our funders include Canada Foundation for Innovation, Canadian Institutes for Health Research, the U.S. Department of Health & Human Services, National Institutes of Health, NARSAD, and the Government of Ontario. Through the CAMH Foundation, donors and philanthropists are valued partners in supporting scientists and research projects. Additionally, we partner with industry in selected clinical trials and other projects.

In 2010 CAMH began a multi-year renovation of its research facilities, which will expand its capacity in imaging, genetics, and other research platforms. This renovation is supported by several grants from the Canada Foundation for Innovation worth \$20 million and two grants from the Ontario Ministry of Research and Innovation worth \$5 million.

## Scope of Research

The CAMH Research Department brings together internationally recognized scientists, state-of-

the-art facilities, a range of professional training opportunities for doctoral and post-doctoral students, and a province-wide network of clinical and program staff. Our departments include Neuroscience Research; Clinical Research; Social, Prevention and Health Policy Research; and the PET Centre (positron emission tomography).

## The PET Centre

CAMH has the only imaging facility worldwide dedicated to the application of Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI) to the investigation of mental disorders, including addiction, and their treatment. The CAMH PET Centre radiochemistry team is an international leader in the development of novel PET imaging agents. These radiolabeled molecules have been used for basic research and for pre-clinical and Phase I studies for new drug development in collaboration with the pharmaceutical industry. The facility has a cyclotron and radiochemistry laboratory for on-site production of the short-lived PET radiotracers. It has two state-of-the-art high resolution PET scanners: a brain imaging research tomograph and a whole body PET/CT scanner.

CAMH is currently expanding its imaging facility with the acquisition of a second cyclotron and a 3 Tesla MRI scanner. The expansion also includes a new radiochemistry laboratory to enhance its capacity to develop and apply new PET radiotracers. CAMH imaging research integrates basic and clinical scientists in a collaborative environment that focuses on maximizing the impact of its research to help those afflicted by mental disorders. Its most recent initiative, neuroIMAGENE, is the first comprehensive research effort to bring together the tools of genetics and medical imaging to tackle the most challenging problems of mental disorders and their treatment.

**2007:** Dr. Julia Knight found evidence that increased vitamin D levels during youth, from sunlight and diet, may reduce risk of breast cancer later in life by over 30 per cent.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

**The Neuroscience Research Department** is dedicated to making discoveries in the brain at all levels that in turn relate to mental health, addictions, and their treatments. The department follows three areas of focus: Molecular Medicine, Psychiatric Genetics, and Clinical & Behavioural Neuroscience. Specific laboratories include:

- Epigenetics
- Biopsychology
- Clinical Neuroscience
- Human Neurochemical Pathology Laboratory
- Laboratory of Cellular and Molecular Pathophysiology
- Molecular Neuropsychiatry and Development Laboratory
- Molecular Neuroscience
- Molecular Pharmacology
- Neurobiology of Alcohol
- Neurobiology of Schizophrenia
- Neuroimaging
- Pharmacogenetics
- Psychiatric Neurogenetics
- Translational Addiction Research

**The Clinical Research Department** is involved in research, treatment, and education. It includes clinical research in:

- Addictions
- Child, Youth and Family
- Law and Mental Health
- Mood and Anxiety Disorders
- Schizophrenia
- Geriatric Psychiatry
- Centralized Assessment, Triage and Support Program
- Dual Diagnosis
- Women's Program
- Community Support Research Unit

**The Social, Prevention and Health Policy Research Department** provides scientific evidence and publications to inform policy decisions, health system redesign, and other interventions. It includes:

- Health Systems Research & Consulting
- Ontario Tobacco Research Unit
- Public Health & Regulatory Policies
- Social and Community Prevention Research
- Social, Equity and Health

CAMH Background: CAMH was created in 1998 through the successful merger of the former Addiction Research Foundation, Clarke Institute of Psychiatry, Donwood Institute, and Queen Street Mental Health Centre.

CAMH is a Pan American Health Organization and World Health Organization Collaboration Centre, and is a teaching hospital fully affiliated with the University of Toronto.

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**2006:** Dr. Peter St. George-Hyslop and his research team discover the molecule, TMP21, that produces the toxic compound amyloid beta I.

– University Health Network

# The Donnelly Centre for Cellular and Biomolecular Research



**Donnelly Centre**  
for Cellular + Biomolecular Research  
UNIVERSITY OF TORONTO



UNIVERSITY OF  
**TORONTO**

It is now clear that continued progress in medicine and health research is dependent upon the integration of technology, expertise, and thought from diverse disciplines. This new theoretical architecture presents a challenge which is best addressed through creation of dedicated interdisciplinary centres.



Photographer: Tom Arban

**1991:** A team led by Tony Pawson of Mount Sinai Hospital's Samuel Lunenfeld Research Institute, and University of Toronto's Department of Medical Genetics and Microbiology identifies how cell receptors transmit signals instructing the cell to change. This discovery will have many benefits, including the development of new cancer drugs.

– University of Toronto, Faculty of Medicine

The University of Toronto has addressed this challenge through the establishment of the Donnelly Centre, a unique institute in which investigators from the Faculty of Medicine, Applied Sciences & Engineering, Arts & Science and Pharmacy are brought together in an open, think-tank environment. The Donnelly Centre is mandated to stimulate novel interactions at the interface of biology, chemistry, engineering and computer science in order to develop and apply new technologies for approaching the most challenging biological problems in the post-genomic era.

The Donnelly Centre takes a holistic approach to biomedical research: by integrating technology, expertise and thought from a diverse array of disciplines, it aims to unravel some of the great complexities of biology. In the process, the Centre is poised to make some significant future advances in medicine and health.

At the Donnelly Centre, biomedical research is defined by three broad platforms:

## 1) Integrative Biology

Includes: Systems Biology; Functional genomics; Proteomics; Bioinformatics; Chemical Biology and Chemical Genomics; Structural biology.

The Donnelly Centre studies the foundations of biology using an integrative approach. Researchers with diverse perspectives and scientific backgrounds work together to investigate the complex ways that genes, proteins and small molecules interact. Their studies span the following disciplines:

**Systems biology:** studies a living organism by viewing it as an integrated and interacting network of genes, proteins and biochemical reactions. Instead of analyzing an individual cell

nucleus, for example, systems biologists focus on all of the components of the cell and the interactions among them, as part of one system.

**Functional genomics:** uses the vast amounts of genomic data to describe gene (and corresponding protein) functions and interactions.

**Proteomics:** is the large-scale study of the structures and functions of proteins, the main components of the physiological metabolic pathways of cells. The term “proteomics” was coined to make an analogy with genomics, the study of genes.

**Ribonomics:** is the large scale study of RNA functions, metabolism, movements and structures. New research is suggesting that RNAs play an equally important role as proteins in the control of cellular architecture and function.

**Bioinformatics:** uses information technology to study biological processes. Recent advances in biological research have led to an explosive growth in scientific data. Bioinformatics develops and advances computerized databases, algorithms and statistical techniques to best store, manage and analyze all this biological information.

**Chemical Biology and Chemical Genomics:** probe living systems at the chemical level. Chemical biology uses chemical compounds, or small molecules, to study and manipulate biological systems. Chemical genomics studies how genes respond to small molecules.

**Structural Biology:** elucidates the molecular structure of biological macromolecules, such as proteins and nucleic acids, and studies how they acquire their structures, and how their function is influenced by their structure.

**2004:** Scientists confirm that childhood and adult brain tumours originate from cancer stem cells and that these stem cells fuel and maintain tumour growth. This discovery has led to development of a mouse model for human brain tumours and opens the door for new therapeutic targets for the treatment of brain tumours.

## 2 ) Bioengineering and Functional Imaging

Includes: Regenerative medicine; technological developments in cell and tissue imaging; high-throughput cell biology.

No holistic approach to biomedical research would be complete without a cell biology platform. Several researchers at the Donnelly Centre study the dynamics of healthy cells, while others investigate abnormal ones, such as cancer cells. A greater understanding of the cellular basis of disease helps to develop improved methods of diagnosing disease and more effective treatments for disease. This research draws upon, and informs, the following disciplines:

**Regenerative medicine:** harnesses the power of stem cells to repair, regenerate or replace diseased cells, tissues and organs.

**Technological developments in cell and tissue imaging:** Recent advancements in imaging technology stem from nanotechnology (e.g., metal-based nanostructures), microtechnology (e.g., micro-sized machines), and molecular engineering (e.g., bacteria-infecting viruses that connect proteins with the genetic information that encodes them).

**High-throughput cell biology:** uses a combination of automation equipment and classical cell biology techniques to perform rapid, large-scale research. It addresses questions such as: how cells function and interact with each other, and how pathogens exploit cells in disease.

## 3) Models of Disease

Includes: Stem cell biology; Model organisms; Animal models of human disease.

The Donnelly Centre also uses model organisms, such as yeast, and stem cells to gain a better understanding of how diseases arise and develop. This research helps to identify new methods for prevention and treatment.

It encompasses:

**Stem cell biology:** studies how human embryonic stem cells develop into malfunctioning cell types (for example, insulin-producing pancreatic cells or heart muscle cells).

**Model organisms:** include yeast – an organism that shares roughly one third of genes with humans – as well as worms and mice. Studying the genetic interactions that cause disease in simple organisms, for example, sheds light on the genetic basis for disease in humans.

**Animal models of disease:** is the study of a non-human animal that has a disease or injury similar to the human condition under investigation.

The Donnelly Centre has devoted an entire floor – more than 20,000 square feet – to the growing field of bioinformatics and computational biology. The large-scale biology projects in the Centre, as outlined above, create massive amounts of data that are essentially meaningless unless analyzed using innovative computer algorithms that help scientists discern important patterns. These patterns reveal new and important information about cell and organism function. Seven bioinformatics investigators were recruited to the Donnelly Centre, through collaborations involving the departments of Computer Science and the Faculty of Medicine: Gary Bader (from Sloan Kettering), Michael Brudno (from UC Berkeley), Brendan Frey (from the Beckman Institute), Ryan Lilien (Dartmouth) Philip Kim (from Yale University), Quaid Morris (from University of Toronto) and Zhaolei Zhang (from Yale University).

**1999:** Dr. Bernard Zinman and his team discover that diabetic First Nation adults have a high frequency of a mutation in the HNF1 gene, called G319S. The mutation was discovered in Sandy Lake natives in Northern Ontario, a community in which about 25% of residents have diabetes.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital



The Donnelly Centre currently houses 30 principal investigators. This scientific community of postdoctoral fellows, research technicians, visiting scientists and scholars interact in stunning open-concept laboratories and meeting space distributed over 10 floors in a research tower that is said to symbolize the dazzling potential of the post-genomic era. By creating an ideal interdisciplinary research environment in a physically arresting space, the Donnelly Centre will encourage outstanding minds to come to and stay in Canada.

For further detail about on-going research programs and positions within the Donnelly Centre please visit [www.thedonnellycentre.utoronto.ca](http://www.thedonnellycentre.utoronto.ca)

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**1999:** Although high rates of breast cancer have previously been noted in Jewish women, Dr. Steven Narod is the first to establish the high rate of inheritance of specific genetic mutations that put Ashkenazi Jewish women at risk for breast cancer.

# The Hospital for Sick Children (SickKids)

# SickKids®

RESEARCH  
INSTITUTE

The Hospital for Sick Children (SickKids) is recognized as one of the world's foremost paediatric health-care institutions and is Canada's leading centre dedicated to advancing children's health through the integration of patient care, research and education.



**2007:** UHN scientists Drs. Hitoshi Okada and Tak Mak have found the Bat3 protein is responsible for activating the p53 protein—a master gene implicated in many human cancers.

– University Health Network

Its mission is to provide the best in complex and specialized family-centred care; pioneer scientific and clinical advancements; share expertise; foster an academic environment that nurtures health-care professionals; and champion an accessible, comprehensive and sustainable child health system.

The SickKids Research Institute upholds an exceptional standard of scientific research and discovery which is guided by our vision of Healthier Children. A Better World. It goes to the heart of what we do to prevent disease, find cures and transform children's health. Our scientists collaborate on hospital-wide child-centred interdisciplinary projects focusing on the life continuum from fetal origins to adult including fundamental discovery, applied research, and outcomes and impact.

Currently, there are more than 2,000 staff and trainees in the Research Institute involved in more than 2,309 funded projects, and more than 2,900 active clinical protocols. Along with 224 scientists and associate scientists and 296 project investigators, there are over 1,000 trainees including graduate students, research fellows, clinician-scientist trainees and visiting scientists from at least 25 countries, as well as laboratory technologists, research assistants and operations and administrative staff. SickKids scientists published more than 1,000 peer-reviewed articles in 2008.

The total research budget for 2008-2009 was more than \$146 million. Funding for research activities and operations comes from many sources. Internal funding is provided through the SickKids Foundation, where community and corporate donors contribute to the Foundation's endowments. External funding comes from many granting sources including government and public and private foundations. Approximately

1,800 peer-reviewed grants are awarded to our researchers each year.

Research at the SickKids Research Institute is organized into seven research programs: Cell Biology, Child Health Evaluative Sciences, Developmental & Stem Cell Biology, Genetics & Genome Biology, Molecular Structure & Function, Neurosciences & Mental Health and Physiology & Experimental Medicine. Core Research Facilities include:

### **Advanced Bioimaging Centre (ABC)**

The Advanced Bioimaging Centre is a joint venture between SickKids and Mount Sinai Hospital. The ABC is located in the Department of Pathology and Laboratory Medicine at Mount Sinai Hospital and provides transmission and scanning electron microscopy services to scientists at these two institutions, and the research community at large.

### **Advanced Protein Technology Centre (APTC)**

In operation for over two decades, the APTC provides protein analysis services to SickKids and the greater research community. They provide analysis in four main functional areas: amino acid analysis, peptide sequencing, peptide synthesis and mass spectrometry.

### **Analytical Facility For Bioactive Molecules**

The Analytical Facility offers a range of services for quantitative and qualitative analysis of biological samples to the greater scientific community.

**2005:** Researchers map the molecular details that show how a viral protein coded in the Epstein-Barr virus immortalizes cells and causes them to continuously grow, thereby predisposing people to certain types of cancer.

– University of Toronto, Faculty of Medicine

## **Biostatistics, Design and Analysis Unit (BDA)**

Operated by the Child Health Evaluative Science Program at the Research Institute, the mandate of the BDA is to improve the quality of research at SickKids by offering consultation in the areas of study design and methodology, statistical analysis and data management.

## **Canadian Mouse Mutant Repository (CMMR)**

The CMMR is a central repository for the cryopreservation and archiving of mutant mouse lines as spermatozoa, embryos and tissues in various formats (fixed, embedded and glass-slide mounted). The CMMR is also the repository and distribution centre for mutant mouse embryonic stem cells from the North American Conditional Mouse Mutagenesis project (NorCOMM).

## **The Centre For Applied Genomics**

The Centre for Applied Genomics (TCAG) is comprised of facilities that provide the resources, technologies and expertise essential for disease gene research and other basic and applied genetic and genomic investigations.

## **Centre for Computational Biology (CCB)**

The CCB provides for the computing, super computing and software needs within the Research Institute and to the greater research community.

## **Clinical Research Centre**

The Clinical Research Centre is dedicated to providing safe and accessible facilities for

physiological patient-based research. Services provided include a cardiopulmonary research exercise laboratory and a clinical investigation unit that offers general patient assessment, specialized metabolic testing and bioelectrical impedance. These services are offered to SickKids research personnel and clinical researchers from other hospitals.

## **Embryonic Stem Cell (ES) Facility**

The ES facility provides reliable, high-quality technical service and support for the maintenance of embryonic stem cell lines and generation of targeted cell lines. They also provide materials, training and technical assistance to researchers. Feeder cells, ES cell lines and reagents are also available from outside users.

## **Flow Cytometry Facility (FCF)**

A joint SickKids and UHN facility, the FCF provides cell analysis services using flow cytometry technology. Flow cytometers detect and quantify a number of cellular parameters as cells are carried in a liquid stream through a nozzle that is illustrated by one or more lasers emitting light of defined wavelengths. This level of analysis allows researchers to use multiple experimental parameters when processing samples.

## **Focus In Synthetic Chemistry (FISC)**

Launched in 2008, FISC researchers within SickKids Research Institute with chemical synthetic expertise develop and improve small molecule modulators of biological systems. These syntheses are targeted to generate molecules which can function with a living system.

**1973:** The first hospital-supported “walk-in” centre offering contraceptives and abortion services opens at Women’s College. The Bay Centre is the site for numerous clinical trials of contraceptives, including the cervical cap and hormonal methods like the pill. Under the leadership of its founding Medical Director, Dr. Marion Powell, it is also involved in some of the first “real world” evaluations of low dose contraceptive pills.

## Imaging Facility

The Imaging Facility provides a full range of biological imaging solutions for life sciences research. Researchers are able to access cutting-edge technologies in biological imaging, which are made available on a fee-for-service basis.

## Monoclonal Antibody Facility

The Monoclonal Antibody Facility produces high-quality monoclonal antibody-producing cell lines and antibody purification services to the greater research community on a fee-for-services basis.

## Research MRI Facility

The research 1.5 Tesla MRI facility provides a wide range of human-imaging and animal-imaging capabilities to Toronto-area scientists. The site is staffed with two full-time research MR technologists.

## Signalling Identification Network (SIDNET)

SIDNET supports high throughput screening projects by providing access to automation platforms, liquid handling systems, detection technologies cDNA expression libraries and shRNA and esiRNA knock-down libraries. SIDNET staff is available to assist in the development of custom assays and automation protocols.

## Toronto Centre For Phenogenomics Transgenic Core (TCP Tg Core)

The TCP Tg Core is an amalgamation of the Transgenic Facilities at Mount Sinai Hospital and SickKids. These facilities have been operating since the early 1990s and have pioneered innovative technologies such as the production of

the chimeras between genetically modified mouse ES cells and embryos using the aggregation method and the tetraploid complementation assay. The TCP Tg Core provides a range of services for genetically engineered mouse models (GEMMs) for research programs hosted at the TCP, TCP member institutes, throughout Toronto and around the world. The TCP Tg Core maintains a close affiliation with the laboratories of Dr. Janet Rossant, Chief of Research at SickKids and Dr. Andras Nagy, Senior Investigator, Samuel Lunenfeld Research Institute, Mount Sinai.

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**2004:** Dr. Steve Gallinger identifies a genetic variation associated with colorectal cancer—the first genetic predictor associated with common forms of colorectal cancer and a tool for future screening methods.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

# The Lawrence S. Bloomberg Faculty of Nursing, University of Toronto



**BLOOMBERG**  
LAWRENCE S. BLOOMBERG  
FACULTY OF NURSING  
UNIVERSITY OF TORONTO

The Lawrence S. Bloomberg Faculty of Nursing at the University of Toronto is one of the most respected schools of its kind in Canada, with a long history of educating nurses to the baccalaureate level and beyond. In 2010, the Bloomberg Faculty of Nursing celebrated 90 years of excellence in scholarship, innovation and diversity in serving humanity.



**1994:** Martin Yaffe and Norman Boyd of Princess Margaret Hospital (University Health Network) show a correlation between breast density and increased risk of breast cancer.

– Sunnybrook Health Sciences Centre

Bloomberg faculty is renowned nationally and internationally for its educational programs and the quality of research carried out by its faculty members. The University of Toronto is one of the top public research universities in North America, offering a distinctive environment for the pursuit and development of knowledge. Parallel to the university's mission, the Bloomberg Faculty of Nursing endeavours to provide a supportive environment for faculty members and students in building research capacity for the development of evidence-based best practices in nursing, health care and the health care system.

The Bloomberg Faculty of Nursing continues to attract research funding from various sponsors including the federal and provincial government. The Faculty averages \$7 million in grant funding and awards annually. In addition, the Bloomberg Faculty of Nursing has a phenomenal nine federally funded and/or endowed research chairs – more than any other nursing faculty in Canada.

The diversified interests in the research areas at the Bloomberg Faculty of Nursing have resulted in the development of the following research themes and clusters.

## Nursing Health Systems

Nursing health systems research involves the application of research methods from social and health sciences, biostatistics, and economics, to investigate questions related to nursing and health services resource planning, organization, management, financing, and delivery. Research foci include health human resources, nurse migration, nursing effectiveness, nursing and health outcomes, nurse costing, quality work environments, health care teams, technology, patient safety, and nursing leadership.

## Effective Care and Health Outcomes

The focus of this research field is on rigorous evaluations of conventional and innovative forms of nursing and health care, using randomized controlled trials, theory-driven evaluations, and systematic reviews of the evidence. Studies are conducted in formal and informal health care settings, addressing a wide variety of health and illness issues in, for example, maternal-newborn health, cancer care, genetics, critical care, cardiovascular disease, acute and chronic pain in adults, infants and children, and in the area of sleep. Many of the studies are multi-disciplinary and international in scope.

Critical Approaches to Health and Health Care Scholars in this research field explore issues in health and health care using a range of critical and social theories as a foundation. The work of this eclectic group incorporates a number of research methodologies, with an emphasis on qualitative, participatory, and theoretical inquiry. Three strands of investigation are pursued. Several members of this field study health disparities that stem from interconnected and marginalizing social relations of gender, income inequality, disability, racism and heteronormativity. Others analyze the historical, ethical and political basis of health care. Finally, there is a strong focus on migration, and international/ global health.

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**2009:** Dr. Russ Callaghan and co-authors find that there is a higher risk of heart disease among people with schizophrenia compared to the general population.

– Centre for Addiction and Mental Health

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## The Clinical Simulation Learning Centre (SIMS Lab)

In its renovated space the Bloomberg Faculty of Nursing has launched a new era in professional education and research for the benefit of the healthcare system and people of Ontario and Canada.

Simulation education is a proven method of introducing and integrating increasingly complex scenarios into the education process. To meet the need for both safe and effective education and professional assessment and retraining, the faculty has created the Clinical Simulation Learning Centre (SIMS Lab) in the Health Sciences Building.

The SIMS Lab includes two distinct learning environments. One replicates a general in-patient unit with 12 beds and a nursing station, while the other replicates a five-bed critical care environment with an isolation room for infectious disease training. Nursing students in our undergraduate, graduate and nurse practitioner programs will use both simulation labs to enhance their psychomotor skills, acquisition and critical thinking skills.

With one of the only simulation learning centres in Canada equipped to replicate a critical care environment with advanced patient simulators (adult and pediatric), the Faculty of Nursing is very excited at the opportunity to be the first to assess the outcome of introducing simulation into nursing education.

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**2010:** Recent findings suggest new methods for harnessing the power of the immune system to respond to viral infections, such as those seen in the 2002-2003 outbreaks of Severe Acute Respiratory Syndrome (SARS). These findings could provide significant help towards the development of novel treatments for coronavirus infections.

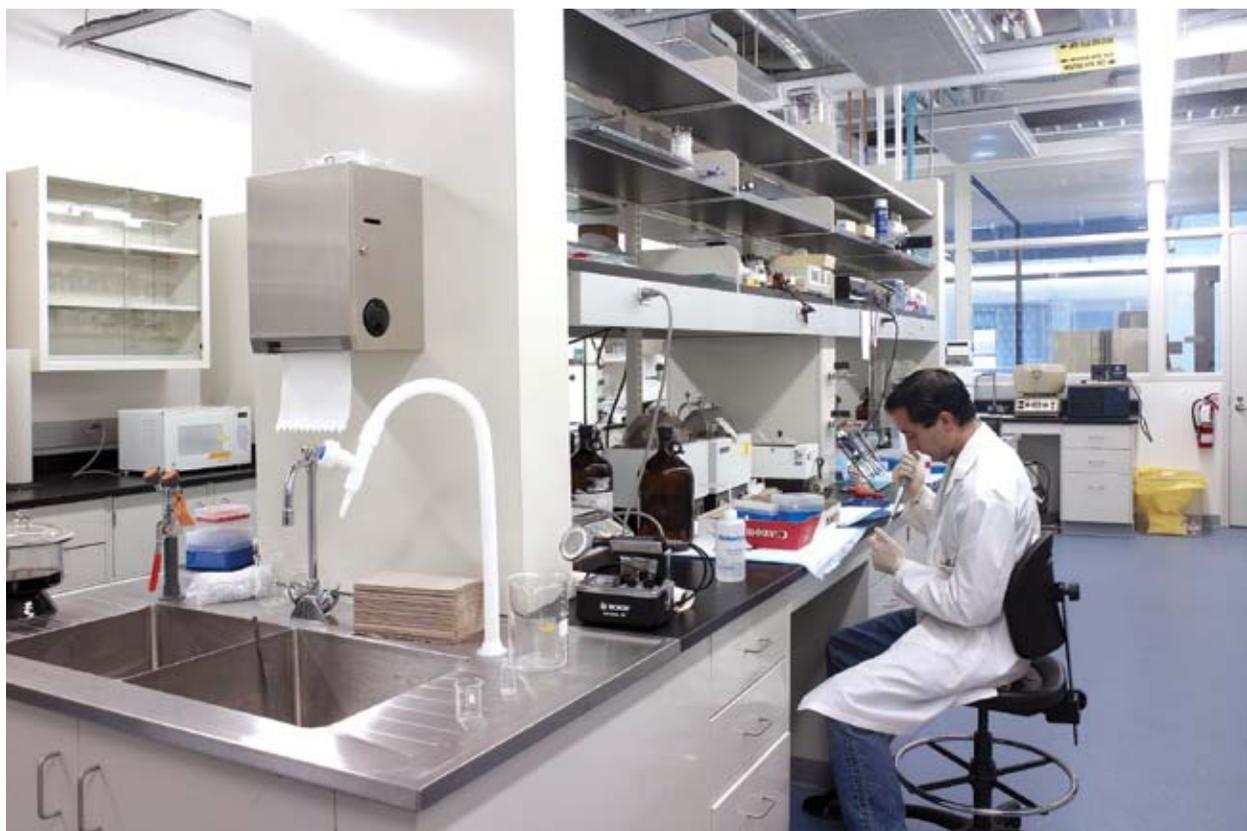
- Dr. Ian McGilvray, Dr. Gary Levy and Dr. Aled Edwards, University Health Network

# The Leslie Dan Faculty of Pharmacy, University of Toronto



UNIVERSITY OF TORONTO  
LESLIE DAN FACULTY OF PHARMACY

The Leslie Dan Faculty of Pharmacy at the University of Toronto is a recognized leader in the field of pharmacy education and research. Located in the heart of Toronto's Discovery District, the state-of-the-art Leslie L. Dan Pharmacy Building is home to over 1,000 undergraduate students in the Bachelor of Science in Pharmacy, Pharmaceutical Chemistry Specialist, and Doctor of Pharmacy programs.



**2008:** Dr. Daniel Drucker reports that a new once-weekly treatment for type 2 diabetes could replace the more common twice-daily injection.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

An additional 140 students with degrees in physical, biological, and social sciences participate in our world-class graduate programs, where they receive cutting-edge instruction from world-renowned researchers in a variety of pharmaceutically based fields as they pursue Master and Doctoral degrees. The Faculty is composed of 35 tenure-track faculty members, 10 lecturers, and a large complement of experts with appointments at the Faculty who are affiliated with nearby research hospitals. As a result, the Leslie Dan Faculty of Pharmacy is one of the largest pharmacy faculties in North America, offering the most innovative and leading-edge pharmacy education programs in the nation, and enjoying an international reputation as a pre-eminent centre for innovation and discovery in pharmaceutical sciences.

The research conducted at the Leslie Dan Faculty of Pharmacy focuses on the discovery, development, administration, and utilization of therapeutic drugs. Faculty members pursue research reflecting the breadth and depth of the questions and issues relevant to modern drug therapy, including the mechanism of action of novel compounds, the politics of drug-distribution policies, and the role of pharmacists in the healthcare system, among many others. The results of this research have a profound impact on drug therapy from the molecular level to entire populations.

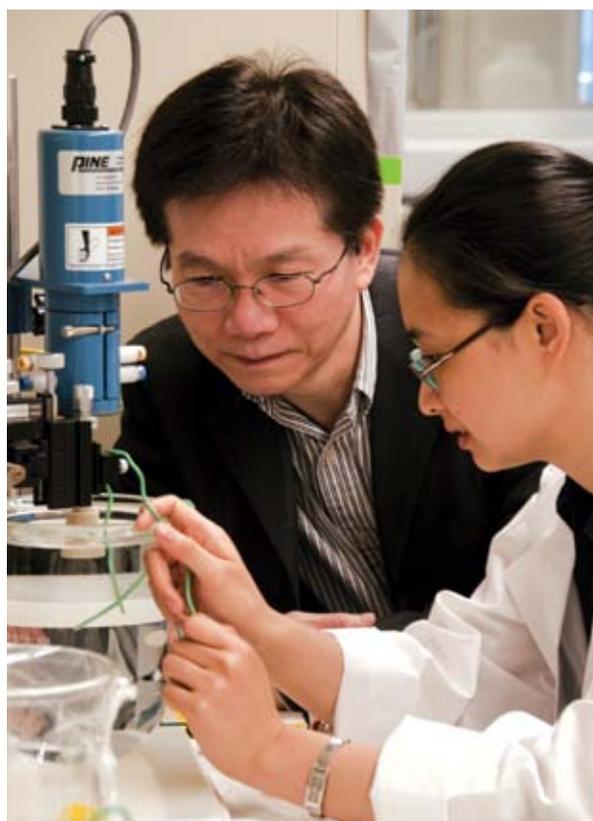
This focus on all facets of drug therapy makes the Leslie Dan Faculty of Pharmacy unique within the University of Toronto, while the scope and importance of the research conducted at the Faculty make it a leader in pharmaceutical research in North America.

Research activities at the Faculty are organized into three divisions:

- Biomolecular Sciences: the molecular and cellular aspects of drug design, action and delivery
- Clinical, Social and Administrative Pharmacy: the social, political, and economic aspects of drugs
- Pharmacy Practice: the role of pharmacists in drug therapy and the health care system

## Biomolecular Sciences

Research in the Biomolecular Sciences Division focuses on three categories: pharmaceuticals and drug delivery, pharmacokinetics, and pharmacology and toxicology. Research activities conducted by Faculty investigators in this division cover the



**1950:** Dr. Marian Hilliard and Dr. Eva Macdonald develop the Pap smear, a simple new procedure readily done in a physician's office to collect cervical cells for cancer screening. Combined with cell staining techniques developed by Georgios Papanikolaou, the new test can now be processed in a routine medical laboratory not a specialized research setting.

spectrum of pharmaceutical research – from fundamental drug discovery at the molecular level to clinical trials – and touch on such diverse health care issues as cancer, HIV/AIDS, neural injuries and diseases, substance abuse, autoimmune diseases, heart diseases and birth defects.

### **Pharmaceutics and Drug Delivery**

Research in Pharmaceutics at the Faculty focuses on designing drugs that are more effectively absorbed by and delivered to the appropriate locations within the body. This includes investigators pursuing the rational design and development of polymer-based drug delivery systems, the use of nanotechnology to detect disease and deliver drugs, the discovery and development of radiopharmaceuticals for diagnostic imaging or targeted radiotherapy of cancer, modulated drug delivery, and the development of new targeted and controlled release drug delivery systems. Researchers in this group hold a number of patents (including one for molecular dispersion composition with enhanced bioavailability) and several commercialization agreements.

### **Pharmacokinetics**

Research in Pharmacokinetics focuses on understanding what happens to a drug once it is introduced to the body, the absorption of the drug, the metabolism of the drug, and the eventual excretion of the drug or its metabolites. Investigators in this branch of pharmaceutical study seek to understand how the organs within the body carry out these processes in both healthy and diseased individuals. They probe the molecular basis of these processes by investigating the ability of drugs to be transported across cell membranes in these different states.

### **Pharmacology and Toxicology**

The research conducted in this group aims to understand the molecular basis of drug action. Investigators study the full range of drug interactions from those that elicit the desired therapeutic response to those that lead to unexpected adverse (or idiosyncratic) drug reactions. A thorough understanding of the interaction of drugs with their therapeutic targets is essential to the development of new drugs and is necessary to understand the unexpected effects of drugs. Idiosyncratic reactions occur in a small percentage of patients that take a drug and, because they represent a serious medical problem, can lead to withdrawal or severe restrictions being placed on the use of a drug, which will significantly add to the cost of drug development.

### **Clinical, Social and Administrative Pharmacy**

Faculty members in this division focus on understanding how and why medicines are used in society and how to optimize pharmaceutical-related regulation, reimbursement, and policy pertaining to medicines and pharmacy practice. Researchers are engaged in studies in a range of fields including pharmaco-epidemiology and health economics, health services and policy research, and bioethics and socio-behavioural aspects of medicine use.

### **Pharmacy Practice**

Researchers in Pharmacy Practice examine the role of the pharmacist in providing patient care in various practice settings, and promote the effective use of medications in patients resulting in positive health outcomes. The faculty members in this division are pharmacists who are generally cross-appointed in clinical sites and are involved

**2001:** Michael Julius and his collaborators at the University Health Network and Osaka University in Japan discover a protein in human breast milk that stimulates the immune system of newborns. This discovery underlines the importance of breast feeding. It also offers the opportunity to supplement baby formula to provide immune system benefits similar to those of breast milk.

in a variety of practices including therapeutic areas (e.g. cardiology, critical care, infectious diseases, rheumatology, and psychiatry) and specific patient populations (e.g. geriatrics, pediatrics, and women's health). Their practices are located in tertiary care and community hospitals, as well as ambulatory care sites.

The Faculty's Office of Continuous Professional Development translates research into practice, offering practical educational programs that improve and expand the competency of pharmacy professionals, researchers, academics, and allied health professionals involved in pharmacy policy and practice. Programs range from short courses and workshops to full certificate programs and customized executive programs that keep professionals aware of recent advances and ahead of emerging practice trends.

The Faculty is home to a large concentration of chairs and professorships funded by the government, professional and industry partners, professional associations, and the University of Toronto. They include:

Canada Research Chair in Adverse Drug Reactions – Dr. Jack Uetrecht

Canada Research Chair in Chemical Genetics – Dr. Guri Giaever

Canada Research Chair in Functional Architecture of Signal Transduction Complexes – Dr. Stephane Angers

Canada Research Chair in Lipid Science and Technology – Dr. Heiko Heerklotz

F. Norman Hughes Chair in Pharmacoeconomics – Dr. Murray Krahn

GlaxoSmithKline Chair in Pharmaceuticals and Drug Delivery – Dr. Ping Lee

Ontario College of Pharmacists Professorship in Pharmacy Practice – Dr. Zubin Austin

The outstanding research conducted at the Leslie Dan Faculty of Pharmacy not only leads to increased efficacy, cost effectiveness, and understanding of medications, but also provides an exceptional learning environment for students at all levels. Located on the University of Toronto campus in close proximity to several major health care institutions, the Faculty is an outstanding centre for pharmaceutical research. The expertise, facilities, and research environment at the Faculty produce an incredible atmosphere for discovery and innovation.

Over the past two years, investigators at the Faculty have entered into a number of commercialization agreements for a variety of technologies, discoveries and innovations produced through their research. These commercialization opportunities include the development of a drug delivery system that can be implanted or injected to provide localized and sustained release of medications in the treatment of ovarian cancer, the development of a sustained release nitric oxide drug delivery system for applications in wound healing including diabetic ulcers, and the development of a technology that combines contrast agents with targeted, long-lasting nano-particles for use in multiple medical imaging platforms. Other developments at the Faculty include the production of a microchip that uses nanotechnology to quickly, efficiently, non-invasively, and cost-effectively identify prostate cancer (as well as other types of cancer, infectious diseases, and potential adverse drug reactions) using a BlackBerry-sized device that can be used anywhere.

**2002:** Discovery that fragile X syndrome (most common inherited cause of mental retardation) is related to glutamate in the brain.

– Dr. Peter Carlen, University Health Network

With its broad focus on all aspects of drug therapy, the Leslie Dan Faculty of Pharmacy is home to global leaders and innovators in pharmaceutical research and discovery. The current researchers and recent developments reinforce the Faculty's longstanding reputation as an international leader in pharmaceutical discovery and innovation.

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**2005:** Dr. Andras Nagy develops Canada's first two human embryonic stem cell lines.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

# MaRS



“The early decades of the 21st Century will be marked by the increased scientific and technological convergence of three fundamental drivers – biotechnology, advanced information technology and nanotechnology [...]. These converging technologies have the promise to achieve tremendous improvements in human capital, innovation, economic performance, and the quality of life.”

– OECD



**1951:** A heart-lung machine is developed by HSC physicians Lawrence Chute, William Mustard and John Keith along with Campbell Cowan, Banting Institute.

– The Hospital for Sick Children

## About MaRS

MaRS Discovery District ([www.marsdd.com](http://www.marsdd.com)) is a not-for-profit corporation founded by leaders from the business and public sectors to improve commercial outcomes from Canada's foundation of science, technology and social innovation.

MaRS works closely with entrepreneurs to grow and scale their ventures into global market leaders – in life sciences and health care, information, communications and digital media technologies, cleantech, advanced materials and energy, as well as innovative social purpose businesses.

MaRS provides business advice and mentorship, market intelligence, entrepreneurship education, seed capital and access to critical talent, customer and partner networks.

The MaRS Centre, located in Toronto's Discovery District, opened in May 2005, and is home to a range of tenants across the innovation spectrum. On-site is the MaRS Incubator, a state-of-the-art incubation facility for young companies as well as the MaRS Collaboration Centre, a full service high-tech conference facility for a range of high quality events.

## Contact Information

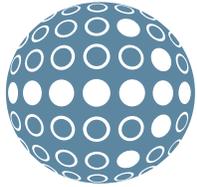
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Business Services  
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**1998:** Drs. Isabella Caniggia and Stephen Lye discover that a biochemical factor, called TGFb 3, remains elevated in preeclamptic pregnancies. Dr. Caniggia later licenses her biomarker findings to help develop a diagnostic tool that will detect and manage preeclampsia in expectant mothers over the next five years.

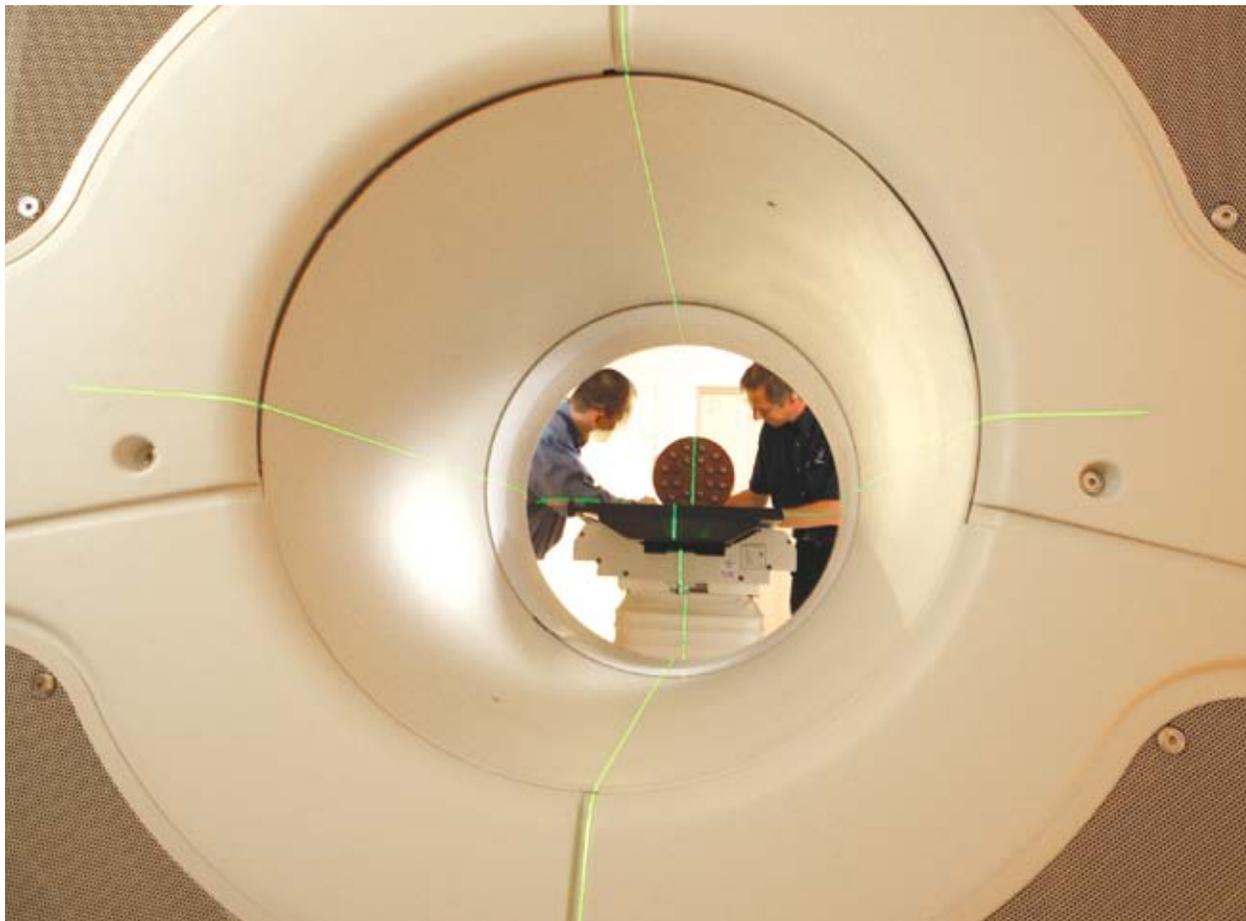
– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

# Ontario Institute for Cancer Research (OICR)



Ontario Institute  
for Cancer Research

Established in December 2005, OICR is a new, innovative cancer research and development institute dedicated to prevention, early detection, diagnosis and treatment of cancer. The Institute is an independent, not-for-profit corporation funded by the Government of Ontario through the Ministry of Research and Innovation.



**1999:** Imaging scientists led by Peter Burns develop the world's first method to image blood flow in the microscopic vessels in the muscle of the heart in real-time, a technique now used internationally. An accurate view of cardiac microscopic vessels is critical to improving diagnosis of and treatment for heart attacks.

– Sunnybrook Health Sciences Centre

OICR has an \$85 million annual operating budget and supports 500 scientific staff and trainees, located at its headquarters and in research institutes and academia across the Province of Ontario. It has key research efforts underway in small molecules, biologics, cancer stem cells, imaging, genomics, informatics and bio-computing, from early stage research to Phase I, II and III clinical trials. It also partners with health services providers in evaluating new cancer services.

OICR's global commercialization program identifies and develops opportunities to collaborate with corporate strategic investors and private equity players in oncology; spearheads the intellectual property program to maximize OICR's extensive intellectual property pipeline, and identifies and accelerates transformative early-stage research and development projects using novel business models.

Pharmaceutical, medical device and biotechnology firms looking to reduce their investment risk and create novel R&D partnerships with access to world-class science and people find OICR an excellent choice. The Institute provides a low risk, variable cost, basic research to proof-of-concept approach which is producing a steady stream of novel products.

OICR's Intellectual Property Development and Commercialization Program provides seed funding for late-stage academic projects that meet specific market-oriented criteria. OICR takes an equity stake and/or royalty in the entity. In return the technology gets funded, de-risked and the participating entrepreneurs gain access to OICR's global commercialization team and its resources.

OICR works with MaRS Innovation (MI), which provides an integrated commercialization platform that harnesses the economic potential of the discovery pipeline of 14 leading Toronto academic

institutions. A not-for-profit organization, MI is funded through the Government of Canada's Networks of Centres of Excellence in Commercialization and Research, and through contributions from member institutions.

OICR has established major partnerships with public organizations: in Ontario, e.g., Cancer Care Ontario; in Canada, e.g., the Terry Fox Research Institute and five federal agencies; and internationally, with the world's foremost cancer and genome research funding agencies in Asia, Australia, Europe and North America. Major corporate partners include international companies such as Pfizer Global Research and GE Health Care, and discussions are ongoing with a variety of other commercial organizations. These partnerships have generated more than \$100 million of direct support to OICR programs based in Ontario, and more than \$250 million to international consortia partners. These initiatives have enhanced the international reputation of Ontario as a centre of excellence for cancer research and will help attract additional research investments to the province in the future.

The Institute's research strategy for 2010-2015 builds on its accomplishments. It sets the direction for the realization of the Institute's vision that will lead to health and economic benefits for the people of Ontario. The research has four objectives:

**1: Facilitate the adoption of more personalized medicine for cancer.**

The initial goals are to establish predictive and prognostic genetic tests and identify biomarkers and more informative diagnostic/monitoring tools that can guide the proper and effective use of cancer therapies that are tailored, as much as possible, for each patient.

## **2: Seek solutions to clinical issues that could benefit patients in the next five years.**

Five clinical challenges are a priority:

- The high fatality of pancreatic cancer;
- The over-diagnosis of prostate cancer;
- The over-aggressive treatment of early stage breast cancer;
- The insufficient participation in population-based screening programs, with a focus on colon cancer screening;
- The long-term adverse effects of treatment affecting cancer survivors, specifically children and young adults.

## **3: Enhance and facilitate the digitization and interpretation of cancer data.**

OICR has large data-intensive initiatives and is developing an integrated, comprehensive environment for storing, exchanging, and analyzing datasets obtained from human subjects. OICR is supporting the commercialization of software and hardware tools through its investment program.

## **4: Accelerate the OICR Patents to Products Program.**

Commercialization is key to bringing therapeutic and diagnostic advances to the clinical setting where they can benefit patients. Downstream products will include:

- Medical devices such as imaging instruments, chemical and antibody tracers for imaging, precision-needles/devices for biopsies;
- Genetic “kits” for disease prediction; Biomarker panels for disease detection, prediction of treatment response, and monitoring;
- Novel immuno- or biotherapeutics;
- Novel drugs; and
- Software for research and clinical applications.

Other OICR initiatives include:

### **OICR Investigator Program**

OICR will continue its program to attract to Ontario and retain a total of 50 outstanding basic scientists and clinician researchers. The majority of OICR awards to investigators are made at Ontario universities and research institutions, supplemented by a cluster in genomics, informatics and medicinal chemistry at the OICR headquarters at the MaRS Centre in downtown Toronto.

### **OICR Personalized Medicine Fund**

The Personalized Medicine Fund supports projects related to:

- Biomarker validation studies that will impact cancer prevention, early detection and therapies;
- Pre-clinical validation of potential therapeutic targets;
- Clinical evaluation of new therapeutic agents/modalities that make use of biomarkers (such as clinical trials companion studies); and
- Development of algorithms or software that will enable the management and delivery of clinically useful information to health care providers. Funds will be available through annual grant competitions, with selections based on recommendations made by peer review panels.

### **Ontario Cancer Research Ethics Board**

The Ontario Cancer Research Ethics Board (OCREB) works in collaboration with Ontario institutions to ensure that clinical research involving human subjects meets the highest standards of scientific and ethical conduct. OCREB is an independent body constituted of medical, scientific and non-scientific members,

**1973:** Use of pulmonary testing called flow volume loop to diagnose small airway disease (e.g., asthma and COPD)

– Dr. Noe Zamel, University Health Network

whose responsibility it is to ensure the protection of the rights, safety and well-being of human subjects involved in a clinical trial. OCREB contributes significantly to the efficiency of multi-institutional trials and currently has participation by 21 Ontario sites involved in cancer clinical trials.

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Website: [www.oicr.on.ca](http://www.oicr.on.ca)

OICR welcomes your comments and questions.

Please email us at: [info@oicr.on.ca](mailto:info@oicr.on.ca).

**2004:** A research team led by Ellen Warner finds magnetic resonance imaging detects more breast cancer tumours earlier, compared with mammography, ultrasound or clinical examination in women with the BRCA1 and BRCA2 genes. This finding offers hope for genetically at-risk women, for whom removal of both breasts is the only other option.

– Sunnybrook Health Sciences Centre

# Ryerson University

RYERSON  
UNIVERSITY

Ryerson is Canada's leader in innovative, career-focused education and a university clearly on the move. It is a distinctly urban university with a mission to serve societal need, and a long-standing commitment to engaging its community.



**1990:** Dr. Alan Bernstein and his team discovered that many human cancers involve defects in a tumour suppressor protein called p53. The discovery helped lead to new diagnostic tools to identify people at risk of certain cancers. As well, knowledge of how p53 works provided researchers with crucial information on the cancer process itself.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

Ryerson is home to 28,000 undergraduate and graduate students and more than 900 faculty members. The university has close to 100 programs, including 9 PhD and 31 Master's programs. Ryerson's ambitious research agenda is on a trajectory of success and growth with more than \$22 million in external research funding.

## Priority areas of research

Ryerson has seven priority areas of research, each with a focus on societal relevance. Faculty provide real-world solutions to real-world challenges.

The seven priority areas of research are:

### **Digital Media, Communication and Information Technology**

Engaging the digital arts, science and technology in a dialogue that fosters a vital exchange of ideas, enables imaginative forms of human communication and informs new and exciting media in business and education. Ryerson faculty are at the leading edge of digital convergence.

### **Energy, Sustainability and the Environment**

Focusing on the complex interactions between the need for development, its effect on the environment and the means for achieving ecological stability and sustainability. This cluster brings together such fields as alternative and conventional energy production, demands on water and other natural resources, climate, materials, built environment and public policy. Ryerson has a strong focus on environmental sustainability and management as well as social policy.

### **Health and Well Being**

Characterized by the interplay of the experimental sciences, engineering, the affiliated health sciences, social sciences and humanities and the knowledge and methods each brings to address

issues of health, stress and well being. Ryerson's role in psychology, nursing, midwifery, nutrition and other allied health care professions, and its cross-disciplinary programs in these areas, makes it ideally suited for a prominent role in new models of medical education and research.

### **Civil Society and Cultural Prosperity**

Representing the contribution of the social sciences, humanities, media and fine arts to the economy and society. Ryerson's tradition of scholarship includes historical studies of culture and cultural institutions, communication studies, ethnoracial diversity, economic inequality, employment policies, food security, public health care policy, family studies, research on aging and the elderly and accessibility. This area also represents the contribution of the social sciences, humanities, media and fine arts to economic prosperity and civil society.

### **Technological and Industrial Innovation**

Exemplifies the contributions made to Canada's economy and society from disciplines in engineering and the physical and life sciences. Ryerson will build on existing strengths in such areas as aerospace and robotics, power systems, electronics, medical physics, biomedical engineering, advanced materials, manufacturing and processing and safety engineering.

### **Management, Competitiveness and Entrepreneurship**

The study of planning, organizing, resourcing, leading or controlling an organization, starting new organizations or revitalizing mature organizations while best managing performance.

### **Learning and Teaching Effectiveness**

Investigating ways to improve education, training and development toward a meaningful and practical body of knowledge about student learning and teaching effectiveness in higher

**2007:** John Dick develops the first experimental murine system to study the full leukaemogenic process in human cells including the initiation and progression of human acute leukemia.

– University of Toronto, Faculty of Medicine

education. As a leader in career-focused and applied university education, Ryerson engages in a wide range of research activities in this area. The Centre for Learning Technologies develops new technologies and assesses their effectiveness in enhancing the accessibility of Canadians with disabilities to social and economic opportunities and in enhancing the capacity of organizations to provide effective services.

## Fast facts about Ryerson University

- more than \$22 million in external research funding
- 12 Canada Research Chairs
- externally funded research has doubled in the past four years
- externally funded research in 2008 grew by 23 per cent over the previous year
- Ryerson is in the top half of Canadian non-medical universities for funded research
- more than 28,000 students
- one of the most culturally diverse student bodies in Canada
- close to 1,000 full-time faculty
- 2,000 graduate students
- 9 PhD and 31 master's programs
- graduate students from 57 countries study at Ryerson
- Ryerson has more first choice and total applications, relative to available spaces, than any other Ontario university.

## Some featured research centres and labs at Ryerson University

### Psychology Research & Training Centre

Dedicated to science, health and discovery, the Psychology Research & Training Centre is home to 23 dedicated research laboratories. Areas of study include the brain and aging, memory and cognition, learning and development, psychology

and law, the study of anxiety treatment, gender and culture, HIV prevention and mental health.

### Digital Media Zone

Launched in 2010, the Digital Media Zone is a unique space run by students for students to innovate and collaborate on digitally inspired ideas. The zone provides support and mentorship with faculty and industry professionals with the goal of bringing ideas to market.

### Rogers Communications Centre

The Rogers Communications Centre is Canada's premier facility for education in digital media communications. Focusing on emerging interactive digital media, the centre has gained an international reputation for strength in advanced research and innovation and is located at the core of Canada's electronic media and digital communications culture.

### Centre for the Study of Commercial Activity (CSCA)

The CSCA is a non-profit research unit studying private-sector economic activities that deal directly with consumers. The centre currently has the support of almost 70 private-sector members and associations. The CSCA focuses on information and analysis that will enable Canada's commercial and retail industries to become more innovative and to improve their competitive economic performance.

### Infoscape Research Lab – Centre for the Study of Social Media

The lab hosts research projects that focus on the cultural and political impact of digital code, particularly with regard to social media. The lab develops software-based research tools, interface designs, and experimental research methods that seek to analyze content and use of new media platforms.

**1976:** Identification of P-glycoprotein as a major cause of cancer drug resistance.

– Dr. Victor Ling, University Health Network

### **Ryerson Multimedia Research Laboratory**

The lab specializes in media indexing and retrieval, human computer interaction, and media coding and transmission. Researchers at the lab developed the world's first non-linear adaptive image/video indexing and retrieval system.

### **Ryerson University Analytical Centre**

Houses the latest PerkinElmer instrumentation: HPLC with UV, refractive index, conductance, and fluorescence detection; GC-MS with autosampler; GC with headspace and purge-and-trap autosamplers; molecular luminescence, UV-Vis, and FTIR spectrometers. Access to ESI/MALDI-Qq-TOF-MS and ESI-Ion Trap-MS is also available within the Department as are opportunities to access PCR (Roche Lightcycler) and DNA sequencing.

### **Physics facilities**

Minimally Invasive Thermal Therapy Laboratory, Human Trace Element Detection Laboratory, Ultrasound Biomicroscopy Laboratory and the Wavelength Dispersive X-ray Fluorescence Laboratory.

### **Aerospace research facilities**

A wide range of research facilities are focused on the aerospace sector. They include:

Aerospace Biomechanics Laboratory: established to perform mechanical testing on soft tissue in isolation. The current major equipment in the laboratory consists of automated biaxial testing apparatus with 50 N maximum loading capacity to perform various test protocols, a CCD camera to measure the strain and a saline circulating bath for tissue preservation.

Space Avionics and Instrumentation Laboratory: supports studies in spacecraft navigation sensors.

Aerospace Vision Management Lab: tests and develops advanced computer vision algorithms for aerospace applications.

Aerospace Systems and Control Laboratory: conducts research in the areas of systems modeling and control, focusing on aerospace systems and robotics.

Facility for Research on Aerospace Materials and Engineered Structures: leading-edge centre of innovation for aerospace materials and structures. Provides a means for performing full-scale structural testing of aerospace components manufactured from advanced materials; and allows for characterization testing of advanced aerospace materials.

## **Contact Information**

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**2001:** Discovery that a protein called Interleukin 13 fuels the growth of Hodgkin's lymphoma.

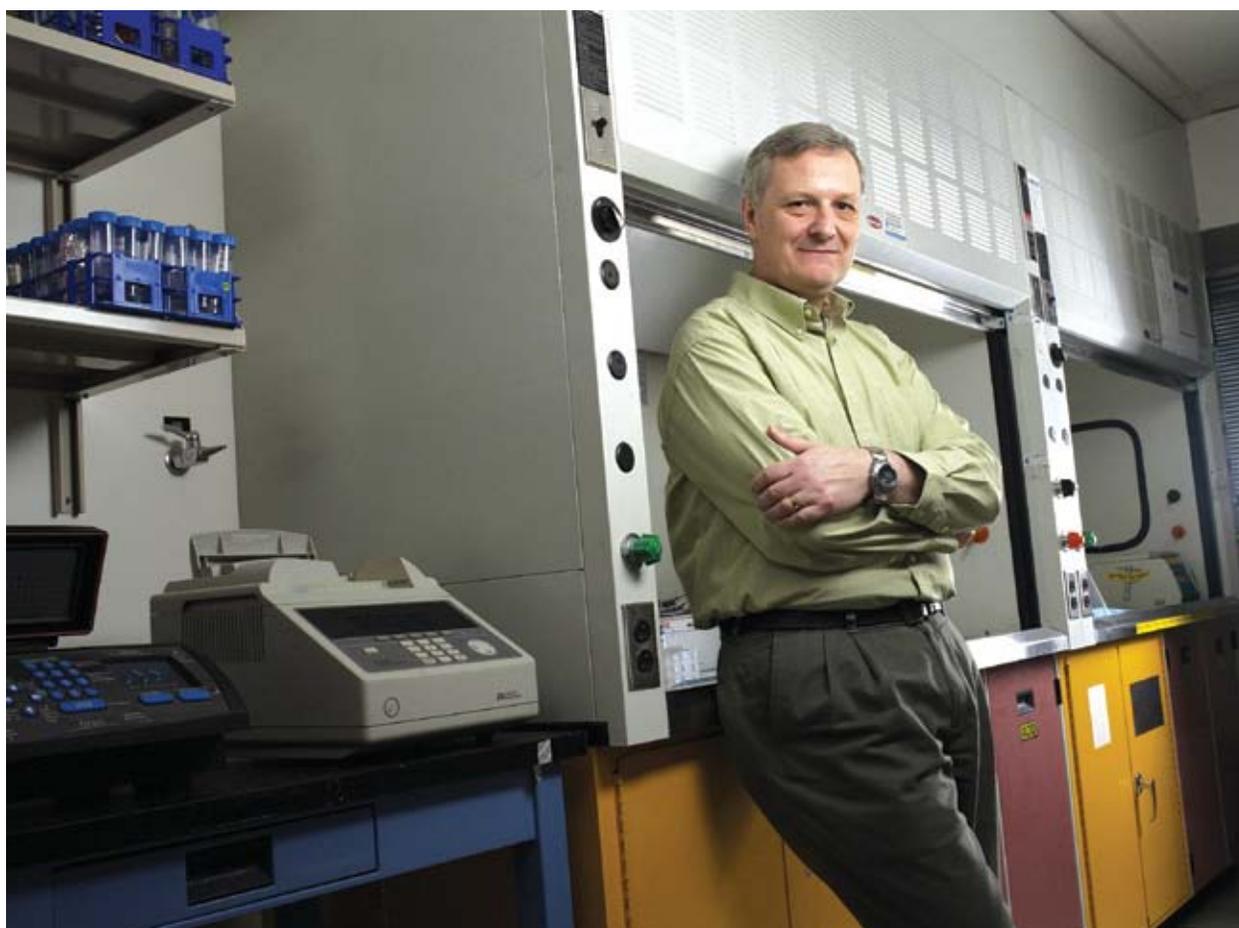
– Dr. Tak Mak, University Health Network

# The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

**MOUNT SINAI HOSPITAL**  
Joseph and Wolf Lebovic Health Complex  
Samuel Lunenfeld Research Institute



The Samuel Lunenfeld Research Institute of Mount Sinai Hospital, a University of Toronto affiliated research centre established in 1985, is one of the world's premier centres in biomedical research.



**2007:** A national study led by OCI and CFIBCR scientist Dr. Norman Boyd identified breast tissue density as a major risk factor for breast cancer.

– University Health Network

Thirty-four principal investigators lead research in diabetes, cancer biology, epidemiology, stem cell research, women's and infants' health, neurobiology and systems biology.

Lunenfeld researchers lead the way in health science research and help to advance the future health of Canadians. Our experts continue to make inroads into the prevention, detection and treatment of cancer, diabetes, arthritis, osteoporosis, psychiatric disorders, kidney disease, women's and infants' health, inflammatory bowel disease, and spinal cord injury.

For more information on the Samuel Lunenfeld Research Institute, please visit [www.lunenfeld.ca](http://www.lunenfeld.ca).

## Prosserman Centre for Health Research

Researchers in the Prosserman Centre for Health Research lead innovative genetic and molecular epidemiological research applying new molecular biology concepts and methods to studies of individuals and human populations. Population, laboratory and clinical studies assess the impact of genetic and environmental determinants of disease on disease risk and evaluation of strategies for treatment and disease control. Primary areas of interest are cancer, heart disease, diabetes and inflammatory bowel disease.

## Centre for Systems Biology

The primary focus of research in the Centre for Systems Biology is the mechanisms through which genes and their products interact to organize both regulatory systems within individual cells and more complex, multi-cellular structures. This is being pursued through analysis of protein complexes involved in signal transduction and the cell cycle, quantitative and qualitative analysis

of specific protein-protein interactions and protein interaction networks and their regulation by post-translational modifications. Such data is combined with high-throughput, array-based screens designed to identify genetic interactions and gene expression patterns to identify sets of genes functioning in common pathways. Researchers in the centre also employ chemical libraries to identify compounds with utility in treatment of disease.

## Centre for Stem Cells & Tissue Engineering

The focus of the Centre for Stem Cells & Tissue Engineering is two-fold: use of embryonic stem cell lines to create mouse models of human disease through transgenesis, homologous and site-specific recombination with embryonic stem cells and secondly, repair or replacement of degenerating tissues through cell-based therapies with particular emphasis on arthritis-related therapies. With respect to human embryonic stem cells, research includes establishment, maintenance and differentiation as well as possible use and safety issues in tissue engineering, regeneration and cell-based therapies.

## Centre for Modeling Human Disease

The Centre for Modeling Human Disease applies state-of-the-art genetic approaches to study the function of genes in the context of an intact organism together with in-depth phenotypic analysis using approaches drawn from physiology, pathology, behaviour, in-life imaging and cell and molecular biology. The Centre provides a platform for integrative, genome-wide generation and analysis of mouse models related to pregnancy and development, diabetes, neurobehaviour, cancer, cardiovascular disease, bone and connective tissue formation and kidney function.

**2000:** Inhaled steroids are found to be safe and effective for children with asthma.

– The Hospital for Sick Children

## Auxiliary Centre for Women's & Infants' Health

Research in the Auxiliary Centre for Women's and Infants' Health is focused on reproductive biology, pregnancy and the transition to the newborn period. Research studies address both normal and pathologic development of embryo, placental and maternal systems during pregnancy and labour defining critical processes during pregnancy with the goal of minimizing fetal, neonatal and maternal death, disability and morbidity. The Centre integrates laboratory-based research, clinical research, teaching and clinical practice.

## Fred A. Litwin Centre for Cancer Genetics

The goal of the Fred A. Litwin Centre for Cancer Genetics is to translate the concepts and techniques of molecular oncology into new approaches to the detection, treatment and prevention of cancer. A common interest of members is population-based studies on the molecular genetics of cancer susceptibility genes and identification and analysis of modifier genes in both hereditary and sporadic cancers. Much of the research is a fusion of molecular genetics, molecular pathology, genetic epidemiology and biostatistics, and the use of high-throughput technologies to rapidly and efficiently translate advances in molecular oncology into clinical practice. Areas of particular focus include breast and colorectal cancer.

## Centre for Genomic Medicine

Researchers in the Centre for Genomic Medicine conduct translational research, and develop strategies and mechanisms to accelerate the application of advances and knowledge in

fundamental science to clinical practice, with the goal to expedite the prevention, diagnosis and treatment of disease. Research in the Centre is carried out by clinician-scientists intimately aware of clinical issues but who are also cognizant of advances in fundamental science and capable of applying them to clinical issues.

## Centre for Neurodevelopment and Cognitive Function

Research within this centre focuses on using both vertebrate and invertebrate animal model systems to study the development and function of the nervous system. Research interests include: studying the fundamental signal transduction cascades and other molecular machineries that govern the development of single neurons to the mammalian brain; establishing the molecular mechanisms that initiate and regulate the formation of connections among the developing neurons; analyzing the function of neural circuits in different animal behaviours; and establishing animal models to study the cause and cure for human neurological and psychiatric diseases.

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Website: [www.lunenfeld.ca](http://www.lunenfeld.ca)

**2003:** SickKids researchers identify, for the first time, a cancer stem cell responsible for brain tumours. This discovery may change how this deadly condition is studied and treated in the future.

– The Hospital for Sick Children

# St. Michael's Hospital

## St. Michael's Inspired Care. Inspiring Science.

St. Michael's Hospital provides compassionate care to all who walk through its doors. The Hospital also provides outstanding medical education to future health care professionals in more than 23 academic disciplines. Critical care and trauma, heart disease, neurosurgery, diabetes, cancer care, and care of the homeless are among the Hospital's recognized areas of expertise.



**2008:** Clinician-scientist Dr. Pamela Goodwin uncovers a link between vitamin D deficiency and poor prognosis of breast cancer. Patients with vitamin D deficiency also had an increased risk of recurrence and lower overall survival rates than those patients with sufficient vitamin D levels.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

Through the Keenan Research Centre and the Li Ka Shing Knowledge Institute, research at St. Michael's Hospital is recognized and put into practice around the world. Founded in 1892, the Hospital is fully affiliated with the University of Toronto.

In 2008-2009, St. Michael's Hospital had:

- 5,264 staff
- 643 physicians and midwives
- 1,660 nurses
- 943 medical residents and clinical fellows
- 230 medical students
- 771 health discipline students
- 429 nurses who are students and/or in continuing education
- 510 volunteers
- 527 inpatient beds (including bassinets) as follows: 407 adult acute care beds; 68 adult intensive care beds and 52 neonatal beds

## The Li Ka Shing Knowledge Institute

St. Michael's Hospital is building the Li Ka Shing Knowledge Institute, the only institute of its kind in North America. The Knowledge Institute, which is scheduled to open in 2011, will marry research and education in a hospital setting in order to best integrate the tripartite priorities of excellence in patient care, research and education. As a 335,000 square foot state-of-the-art facility, the Knowledge Institute will be comprised of two nine-storey centres: the Keenan Research Centre and the Li Ka Shing International Healthcare Education Centre.

## The Keenan Research Centre

The Research Centre's goal is to improve human health and patient outcomes by generating new medical knowledge. We will attract and motivate creative individuals who work together

in a stimulating and collaborative, intellectual environment. St. Michael's research strengths and priorities lie in several well-established programs including Critical Care, Inner City Health, Global Health and Knowledge Translation.

Critical care research is comprised of a matrix which includes three cross-cutting themes in regenerative medicine, inflammation/injury and molecular and genetic determinants of disease. These themes span clinical specializations in vascular biology, trauma/respiratory failure, diabetes/kidney and blood research, which together form a comprehensive program in basic and clinical research.

The Centre for Research on Inner City Health is the first centre of its kind in Canada whose mission is to improve the health of urban populations through a program of clinical and policy-relevant research. Particular emphasis is placed on the needs of socially disadvantaged and economically deprived groups, including the homeless and underhoused, those suffering from mental illness and patients diagnosed with diseases including HIV/AIDS and tuberculosis.

The Centre for Global Health Research is focused on large scale epidemiology (i.e. the cause, distribution and control of disease in populations). At present, the largest cohort study in the world is being conducted at the Centre, encompassing a population of 14 million people in India. Global health researchers are also focused on broader issues including international bioethics, infectious diseases in immigrant populations, HIV/AIDS intervention and prevention in Africa and health systems reform in China.

Research expertise expanded in the fall of 2005 to include Knowledge Translation, as a result of the affiliation of the Knowledge Translation Program at the University of Toronto with St.

**2008:** Dr. Gillian Hawker and her team develop a simple 11 question scale to accurately measure arthritis pain. The scale is the first tool to assess both types of pain described by people with arthritis – achy, constant, background pain and intense incidents of unpredictable pain. The scale has been transferred into 10 languages and is now being used by scientists around the world.

Michael's. St. Michael's is forging a unique niche in Knowledge Translation through innovative research and through close collaboration of research and education, by integrating an evaluative component to education and training. Knowledge translation is the field of research and practice that develops and uses ways to increase the likelihood that patients and clinicians incorporate proven knowledge into clinical practice.

Over the last eight years, overall research activity has experienced a significant growth trajectory with over 150% growth in external funding. One hundred and eighty researchers currently work out of seven research sites and lead approximately 400 research staff.

The Keenan Research Centre will consolidate the Hospital's growing research community into one location. In doing so, the Research Centre will act as a catalyst for the development of synergistic relationships, and promote new methods to address complex health issues from multiple perspectives. As part of the Li Ka Shing Knowledge Institute, the Keenan Research Centre will enable the marrying of research and education in one setting, providing fertile research and training ground to bring new research to patients at St. Michael's Hospital and across the world.

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# Sunnybrook Research Institute (SRI)



Sunnybrook Research Institute (SRI) is the research arm of Sunnybrook Health Sciences Centre. Our main aims are to understand and prevent disease, and to develop technologies and treatments that enhance and extend life. These aims derive from a core vision: to invent the future of health care.



**2009:** Andras Nagy developed a new efficient way to successfully convert mature cells into the functional equivalent of embryonic stem cells. This is regarded as a major breakthrough for the potential therapeutic use of stem cells in human disease.

– University of Toronto, Faculty of Medicine

Sunnybrook Research Institute has grown to become one of Canada's largest research institutes. In 2008/2009, external funding topped \$62 million. Research space at the Sunnybrook campus comprises 250,000 square feet, and will soon include another 150,000 square feet once the Centre for Research in Image-Guided Therapeutics is built. The centre, which will be unique in Canada and perhaps the world, will add two new floors and almost double the space dedicated to discovery at Sunnybrook.

It will equip our research teams with everything they need to invent the medical imaging technologies and therapies of tomorrow. It will bring together scientists and research-minded clinicians, along with highly skilled lab staff and trainees, into one state-of-the-art space to work cheek by jowl on making new discoveries.

These discoveries will lead to new and better ways to detect, diagnose and treat some of the most pressing problems in health care, among them cancer, heart disease, musculoskeletal disorders, immune-system deficiencies, stroke and Alzheimer's disease.

Research at SRI spans the spectrum of discovery from basic science to translational research to knowledge transfer. A distinguishing feature of SRI is the integration between clinical and scientific activities. There are seven areas of focus: brain sciences; cancer (Odette Cancer Centre); heart (Schulich Heart Centre); musculoskeletal (Holland musculoskeletal program); trauma, emergency and critical care; veterans and community; and women and babies. There are five scientific disciplines: clinical epidemiology, clinical integrative biology, combined health services sciences, imaging, and molecular and cellular biology. Each scientist is aligned with a discipline and a program. This enables scientists and clinicians to work with one

another in tightly knit pursuit of the same aims toward the same vision, one that ultimately will benefit humanity as a whole.

More than 200 scientists and clinician-scientists at SRI are working in the following three priority science areas toward achieving that vision:

**Genes, proteins and cells:** Research in this area, which spans strategic program areas with a particular emphasis on regenerative medicine, aims to discover and explain how molecules and cells work toward preventing disease and improving diagnosis, treatment and prognosis. Main areas of expertise in this area are inflammation, infection and immunity, stem cell biology, cell cycle control, signal transduction, vascular modelling, angiogenesis and antiangiogenesis.

**Imaging:** Research in this area concentrates on the development and refinement of technologies to visualize cells, tissues and organs. Blending physics, mathematics and engineering, SRI expertise spans multiple imaging modalities: ultrasound, magnetic resonance imaging, digital mammography and tomosynthesis, X-ray, and positron emission tomography/computed tomography. These technologies are clinically relevant to the diagnosis of disease, and the guiding and monitoring of therapies, including minimally invasive surgical techniques, across strategic program areas.

**Clinical epidemiology:** Research in this area explores the causes, consequences and treatment of disease to improve patient care and ensure health care resources are used wisely. SRI's expertise is in applying epidemiologic methods to issues in medicine across strategic program areas. This includes analyzing disease incidence, treatment efficacy and outcomes, as well as policies and the economic impact of

diagnostic tools and therapies. Methods are diverse: clinical trials, meta-analyses, surveys and database studies. Sunnybrook scientists work with faculty at the Institute for Clinical Evaluative Sciences and with policy makers to inform decisions about health care.

Commercialization is also a focus of research efforts at SRI, and we have a strong track record in the area. Several successful spin-off companies have emerged from here, including VisualSonics Inc., Sentinelle Medical Inc. and Profound Medical Inc. In 2008/2009, we had \$12 million in industry-sponsored research from Apotex Inc., GE Healthcare, Philips and Pfizer Canada, among many others. Indeed, the world headquarters of Sanofi Pasteur's Cancer Vaccine Program is located here. Sanofi Pasteur, Canada's largest vaccine company, sponsors cancer vaccine research at SRI through its Cancer Vaccine Network, thereby capitalizing on the acumen of our immunologists. Sanofi Pasteur provides the vaccines, and SRI scientists test them in clinical trials, the results of which then inform the creation of new and better vaccines.

## Breakthroughs at Sunnybrook Research Institute

Sunnybrook Research Institute continues to invent the future of health care, one advance at a time:

- Immunologists at SRI were the first in the world to create a simple system to generate T cells, a vital component of the immune system, in a petri dish. This discovery points the way to the eventual development of clinical therapies for people with devastated immune systems, for example, those with acquired immune deficiency syndrome.
- Imaging scientists at SRI developed the world's first method to image blood flow in the

microscopic vessels of the heart in real time, a technique now used internationally.

- Cell biologists at SRI showed that lower doses of chemotherapy given with antiangiogenic drugs significantly delays the growth of tumours in preclinical models, a molecular breakthrough that clinical trials teams worldwide are now seeking to validate.
- Physicists at SRI invented a magnetic-resonance-guided high-intensity focused ultrasound therapy that can ablate uterine fibroids in women. The procedure is fast, painless and noninvasive—real benefits for women with this condition, for whom the only other option is frequently surgery. Sunnybrook and partner Thunder Bay Regional Research Institute are conducting the first Canadian clinical trials of this treatment.
- Brain scientists at SRI showed that bright artificial light therapy is as effective as antidepressant medication in the treatment of winter depression. They also showed it works faster, and produces less agitation and sleep disturbance and fewer palpitations.
- Researchers at the Odette Cancer Centre were the first to show that magnetic resonance imaging detects more breast cancer tumours, earlier, compared with mammography, ultrasound or a clinical exam in women with the BRCA1/BRCA2 gene, who are at much higher risk of being diagnosed with the disease. These results have informed clinical practice, such that the American Cancer Society now recommends annual MRI scans, along with mammography, for high-risk women.
- Heart researchers at SRI provided compelling evidence to suggest that artery grafts from the forearm should be used in place of vein

**1963:** Dr. Elizabeth Forbes introduces mammography to Ontario in 1963 developing and evaluating the training and procedures necessary to implement this new technology.

– Women's College Hospital

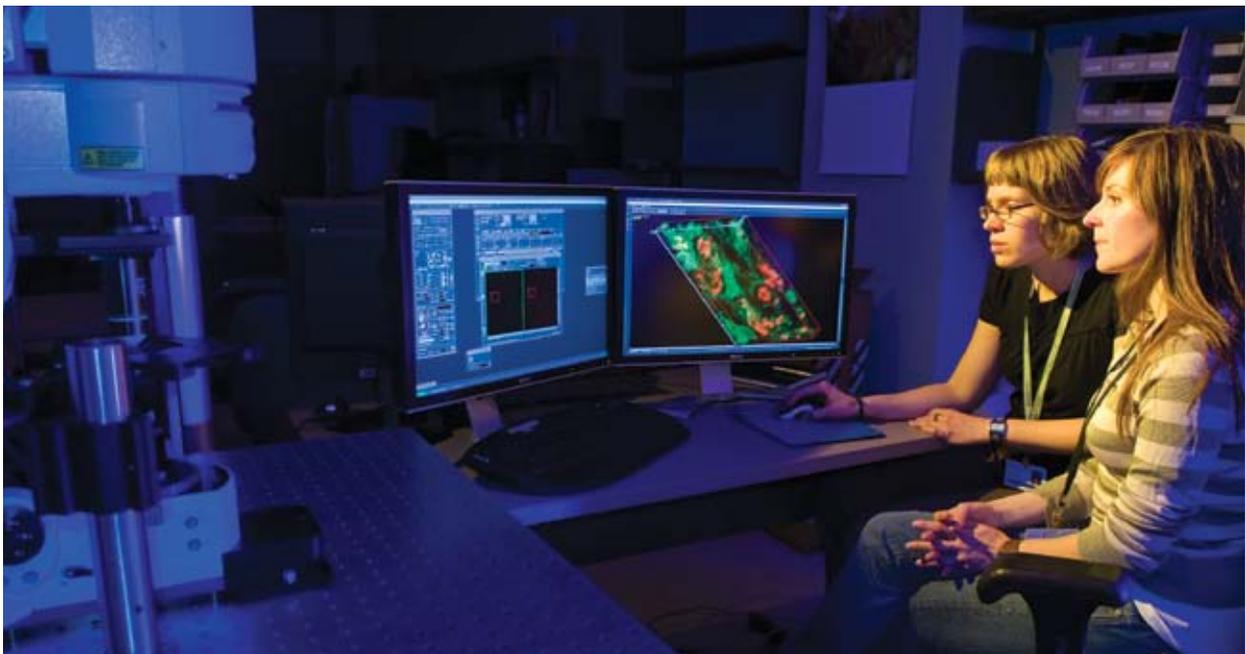
grafts from the leg for heart bypass surgery, a finding that challenges more than 30 years of surgical practice.

- Cancer researchers developed and commercialized a magnetic-resonance-guided transurethral ultrasound therapy for prostate cancer. An alternative to radical prostatectomy, the treatment targets only cancerous cells, thus avoiding healthy tissue and limiting damage to reproductive, bowel and bladder function.

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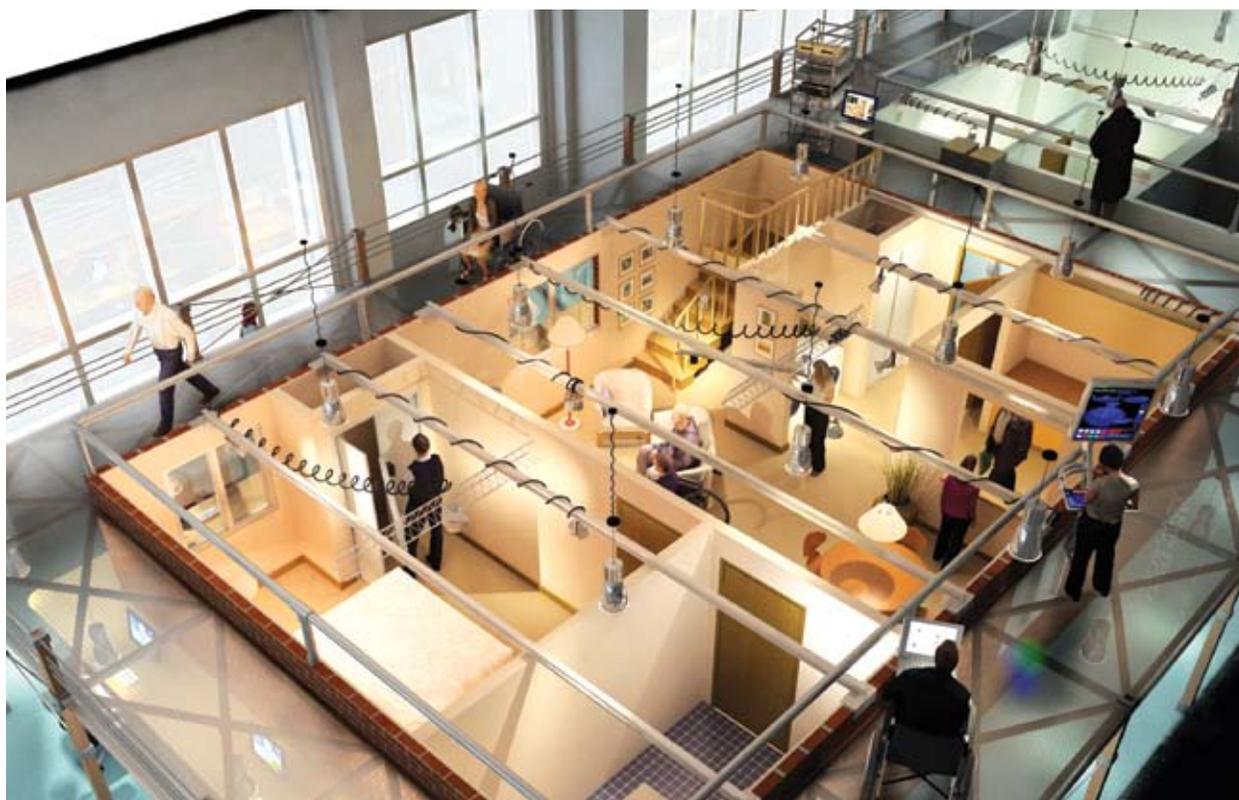
**1934:** Doctors Fred Tisdall and Theo Drake, working with the National Dairy Council demonstrate the value of enriching milk with vitamin D.

– The Hospital for Sick Children

# The Toronto Rehabilitation Institute (Toronto Rehab)



The Toronto Rehabilitation Institute (Toronto Rehab) is at the forefront of one of the most important frontiers in health care today – rehabilitation science. A teaching and research hospital affiliated with the University of Toronto, Toronto Rehab is dedicated to revolutionizing rehabilitation and maximizing life for the 4.4 million Canadians, and millions more worldwide, living with disabling injury and illness or age-related conditions.



**2005:** Georg Bjarnason's research team finds that patients treated with high-dose radiation for head and neck cancer in the morning have a lower risk of developing a kind of side effect that damages the mouth and throat than do patients who are treated in the late afternoon. It is the first study to show a link between circadian rhythms and the development of mucositis due to radiotherapy.

## Research at Toronto Rehab

Toronto Rehab research is all about finding solutions through innovative interventions, clinical practices and technologies to improve the lives of people living with the effects of disability, illness and aging. Our research benefits people whose lives have been affected by conditions such as stroke, cancer, brain injury, heart disease, spinal cord injury, hip fracture, and Alzheimer's disease.

### We are developing:

- New and improved treatments and technologies that increase the level and speed of recovery
- Affordable technologies that increase accessibility and enable people to age in place in their homes and communities
- Technologies that enhance the safety and effectiveness of caregivers
- Technologies and interventions to prevent injuries and disease that lead to disability and to help achieve and sustain fitness.

Our research program also assists the Ministry of Health and Long-Term Care in the provision of equitable and cost effective rehabilitation services.

### Toronto Rehab research is:

- innovative and practical – harnessing the power of technology, industry and bright research minds to find practical solutions to everyday challenges experienced by those affected by injury, disability and advancing age
- collaborative, as Toronto Rehab works with a broad network of Canadian and international partners committed to generating new knowledge in rehabilitation science and applying it to enhance people's lives
- commercialization-focused, as it supports

research that leads to the development of new and marketable assistive technologies, devices and products and is home to the Ontario Rehabilitation Technology Consortium

- unique, as it is the only adult hospital in Ontario with a mandate to advance rehabilitation science through research and is home to one of the world's most comprehensive rehabilitation research programs

## Collaborative Research Environment

Toronto Rehab's cross-functional research teams perform in a collaborative and multidisciplinary environment. Working with clinicians, students and investigators from the University of Toronto and other top academic institutions in Canada, the U.S. and throughout the world, research teams turn innovative ideas into practical solutions, interventions and products. In all, more than 85 scientists and over 150 graduate and postdoctoral students conduct research in eight areas:

### Activity

The Activity Team conducts research to improve participation in daily life for older individuals and those who have experienced a stroke, spinal cord injury or traumatic brain injury. Researchers are developing new therapies and clinical assessment tools, as well as assistive technologies.

### Cardiopulmonary Fitness

The Cardiopulmonary Fitness Team identifies best practices for cardiac rehabilitation. Researchers are working to improve access to rehabilitation services, and developing new models to improve the effectiveness of exercise and lifestyle interventions.

### Cognition

The Cognition Team is working to prevent brain injury and to improve recovery for people living

**2006:** Stephen W. Scherer maps copy number variations in the human genome, demonstrating the ubiquity and complexity of this form of genomic variation and showing that copy number variations assessment should now become standard in the design of all studies of the genetic basis of phenotypic variation, including disease susceptibility.

– University of Toronto, Faculty of Medicine

with brain injury. Researchers are developing therapies, identifying best practices, and conducting population-based research.

### **Communication**

The Communication Team undertakes research to improve assessment and treatment of communication deficits related to aging, in particular to, neurological conditions such as dementia, stroke, and Parkinson's disease. The team also develops new assistive technologies that aid communication.

### **Mobility**

The Mobility Team develops therapeutic techniques and assistive technologies to improve people's mobility and reduce the risk of falling. Researchers are also devising new training programs and equipment to improve health among those with neurological injury.

### **Optimization of the Rehabilitation System**

Team Optimize investigates ways of improving the efficiency and effectiveness of all aspects of rehabilitation service delivery. Team Optimize is also home to the Strategic Policy and Research Communications (SPARC) unit, which acts as a liaison between Toronto Rehab researchers, provincial rehabilitation stakeholders and the Ministry of Health and Long-Term Care.

### **Sleep**

The Sleep Team focuses on the diagnosis and treatment of sleep apnea. The team is investigating the causes of sleep apnea, and the impact of treating the condition on patients with cardiovascular and cerebrovascular diseases.

### **Technology**

The Technology Team develops technologies to help people live more safely and independently in their own homes and communities, and to assist family and professional caregivers. The team also

prepares advanced equipment that researchers and industry partners can use to produce meaningful products for the market.

## **iDAPT – A World First in Rehab Science**

Toronto Rehab is home to one of the world's most advanced rehabilitation research environments. iDAPT (Intelligent Design for Adaptation, Participation and Technology) is a \$36-million research infrastructure facilities project that brings together the brightest research minds and state-of-the-art technology. When fully operational in 2011, iDAPT will consist of 12 laboratories, workshops and other research spaces located throughout Toronto's Discovery District with a focus on sharing new knowledge and creating treatments and assistive technologies to enhance lives affected by disability and age. Among our iDAPT facilities:

### **Challenging Environment Assessment Laboratory (CEAL)**

This huge underground lab will feature the world's first hydraulic motion simulator that can mimic everyday environmental challenges faced by older people and those with disabling injury or illness. Using a multitude of customizable testing environments, researchers will be able to recreate conditions such as ice and snow, different terrain and slopes. This will allow researchers to safely and accurately measure the difficulties encountered in the real world. The lab will also be used to evaluate the impact of new treatments, devices and technologies developed at Toronto Rehab. CEAL will be fully operational by February 2011.

### **Controlled Climate Performance Lab**

The temperature and humidity in this lab can be changed to replicate a range of environmental conditions from frozen winter (-20C) to stifling

**2003:** Neil Cashman and researchers at Caprion Pharmaceuticals discover a way to make the immune system specifically recognize infectious prions, proteins that cause brain-wasting diseases like mad cow disease and Creutzfeldt-Jakob Disease, its human equivalent. This discovery paves the way for the development of diagnostic tools, immunotherapy and a vaccine.

summer (+35C) and up to 95% RH (relative humidity). Investigators are using the lab to develop and test state-of-the-art winter clothing and footwear that is safe and user-friendly for older people and those with disabilities. The lab is also used to examine how the body responds to heat and cold, and to develop exercise programs for people with health conditions such as heart disease and asthma. This lab is fully operational.

### **IATSL – HomeLab**

This “home within a lab” will provide a setting where researchers can create and test new tools to help older people and those with disabilities stay at home longer and more safely. The Intelligent Assistive Technology and Systems Lab - HomeLab will resemble a typical single-storey dwelling. With functional plumbing and wiring, people will be able to occupy the living space and test innovations. An overhead catwalk and suspended grid will enable devices, such as overhead lifts and ceiling-mounted monitoring systems, to be tested. The lab will be used to study challenges people face in their homes and to test artificial intelligence and other approaches that support aging in place. Research will also focus on easing the burden on family caregivers. This lab will open in February 2011.

### **Rapid Prototyping Workshop**

Three-dimensional plastic prototypes are manufactured with unprecedented speed, function, sophistication, and style in this high-tech workshop. Our rapid-prototyping capabilities provide researchers with the opportunity to develop, fit and test parts and devices quickly, without the high costs of tooling and moulding, or to build complicated parts that cannot be made with traditional techniques. iDAPT’s rapid-prototyping capability also equips scientists with the ability to manufacture small quantities of products for immediate testing, validation or impact measurement in the living, working and



learning environments. The workshop is also equipped for machining of metal and plastic, welding, and woodworking. Contract work from other research institutions and the private sector is welcome. The workshop is fully operational.

### **Rehabilitation Engineering Lab**

This lab is based at the largest rehabilitation program in Canada for people with spinal cord injuries and related non-traumatic neurological conditions and is the state-of-the-art facility in the field of neural engineering and neurorehabilitation. Investigators develop sophisticated neuroprostheses, neurorehabilitation systems, brain machine interfaces, and diverse assistive technologies. The lab has a track record in conducting randomized controlled trials with

**1996:** Description of a substance that causes intestines to regrow (GLP-2).

– Dr. Dan Drucker, University Health Network

various neuroprostheses and is one of the leading institutions in the world in the field of functional electrical stimulation therapy. This lab is fully operational.

iDAPT facilities also include labs to study sleep, swallowing, mobility and biomechanics, to name but a few, and workshops to develop assistive technologies. In all, iDAPT consists of over 65,000 square feet of newly created or renovated research space at Toronto Rehab's University and Lyndhurst Centres and the Rehabilitation Sciences building of the University of Toronto.

### Join The 'Club'

Rehabilitation research is poised for exponential growth and Toronto Rehab is well positioned to lead the way. iDAPT embraces collaboration and welcomes both industry and research institutions as partners in developing meaningful products. Join our industry-friendly research 'Club' and an organization that is committed to working with researchers, students, clinicians and the private sector as equal partners.

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**2007:** Working with Israeli scientists, Dr. Steven Narod demonstrates that although two inherited genetic mutations (BRCA1/BRCA2) dramatically increase a woman's risk of getting cancer, she is at no more risk of death or treatment failure than any other woman diagnosed with breast cancer – an important and reassuring fact for affected families and one that will help clinicians choose appropriate treatments.

# University Health Network (UHN)



University Health Network

Toronto General Hospital Toronto Western Hospital Princess Margaret Hospital

University Health Network (UHN) is Canada's premier academic health sciences centre. Our three-hospital complex focuses on excellence in cancer care (Princess Margaret Hospital), cardiac care, organ transplants and the treatment of complex patient needs (Toronto General Hospital) and neurological and visual disorders, arthritis and musculoskeletal disease and community health (Toronto Western Hospital).



**1988:** Dr. Victor Ling discovers the process which cancer cells use to resist anti-cancer drugs.

– University of Toronto, Faculty of Medicine

UHN's three research institutes (Ontario Cancer Institute, Toronto General Research Institute, Toronto Western Research Institute) house 536 principal investigators and their research programs in 735,000 sq. ft. of space, with research funding in excess of C\$261 million (2009).

As the University of Toronto's largest affiliated teaching hospital, UHN collaborates with highly regarded partners across a variety of sectors. Together, these synergistic relationships lead to significant improvements towards human health.

## UHN's Research Institutes

### Ontario Cancer Institute (OCI)

Established in 1952, the Ontario Cancer Institute—the research arm of the Princess Margaret Hospital—is one of the leading centres for cancer research in the world.



OCI researchers employ state-of-the-art tools in genomics, proteomics, structural biology, molecular biology, biophysics and the behavioural sciences. With these tools they analyze cancerous cells at the molecular level; test gene and cellular therapies for cancer and other diseases; develop new technologies for diagnosing and treating cancer; determine the effects of diet and behaviour on cancer risks; and develop and test informatics tools for the large-scale analysis of patient populations. OCI also includes The Campbell Family Cancer Research Institute and The Campbell Family Institute for Breast Cancer Research.

### Toronto General Research Institute (TGRI)

Toronto General Hospital is well known for its excellent clinical care and ground-breaking research efforts that underlie its surgical and medical innovations. Research at the laboratories and clinics of the TGRI has led to major breakthroughs in organ transplants, cardiac pacemakers and novel therapies for endocrine and autoimmune disorders. Some of these breakthroughs include the world's first single and double lung transplantation and the use of insulin to treat diabetes. TGRI's research program includes research in cardiology, transplantation, immunology and autoimmunity, infectious diseases, tissue injury and diabetes.

### Toronto Western Research Institute (TWRI)

Located at the Toronto Western Hospital, TWRI is home to the research programs associated with the neural and visual sciences, musculoskeletal disease and urban and community health programs at UHN. Neuroscientists here explore the function of the nervous system as they develop treatments for spinal cord injuries, cerebral ischemia, vascular malformations, brain tumours, neurophthalmologic disorders and neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease. Their

**2007:** Dr. Lorraine Lipscombe works with Dr. Janet Hux at the Institute for Clinical Evaluative Sciences to demonstrate that rates of diabetes in Ontario are increasing dramatically, far beyond World Health Organization predictions. The increase is most pronounced in women ages 20-49.

investigations are aimed at revealing the causes of, and generating therapies for, these ailments.



#### **UHN Research at a Glance:**

##### **2008-2009 Statistics**

- Over 500 scientists and clinician scientists
- Total research funding > \$261 million
- Clinical studies and corporate contracts > \$34 million
- Funding from over 225 Canadian and international research granting agencies and foundations, as well as from companies in pharmaceutical and biotechnology sectors and UHN's three Foundations.

##### **State-of-the-art facilities**

- Analytical Genetics Technology Centre ([www.analyticalgenetics.ca](http://www.analyticalgenetics.ca))
- Microarray Centre ([www.microarrays.ca](http://www.microarrays.ca))
- Proteomics Group ([www.uhnresearch.ca/proteomics](http://www.uhnresearch.ca/proteomics))
- Global eHealth ([www.ehealthinnovation.org](http://www.ehealthinnovation.org))
- Advanced Optical Microscopy Facility ([www.uhnresearch.ca/omm/aomf](http://www.uhnresearch.ca/omm/aomf))
- Laboratory for Applied Biophotonics ([www.uhnresearch.ca/facilities/LAB.htm](http://www.uhnresearch.ca/facilities/LAB.htm))
- Wright Cell Imaging Facility ([www.uhnresearch.ca/wcif](http://www.uhnresearch.ca/wcif))
- Applied Molecular Profiling Laboratory

([www.uhnresearch.ca/facilities/ampl.htm](http://www.uhnresearch.ca/facilities/ampl.htm))

- Laboratory for Applied Biophotonics ([www.uhnresearch.ca/facilities/LAB.htm](http://www.uhnresearch.ca/facilities/LAB.htm))

#### **A Home for Innovation**

UHN is undergoing a vast physical transformation that includes new research spaces. UHN's Toronto Medical Discovery Tower, completed in 2005, is part of Phase I of The MaRS Centre. This 15-floor, 400,000-sq. ft. building has been designed with state-of-the-art biomedical research facilities and houses some of Toronto's most advanced programs in genomics, integrative biology, infectious diseases, image-guided therapy, structural biology, regenerative medicine, stem cell research and drug discovery as part of the research institutes of UHN. In 2013, TWRI will open its doors to the Krembil Discovery Centre (KDC), a \$165 million state-of-the-art facility that will span nine floors, 150,000 square feet of lab space and 50,000 square feet of clinical research space. Upon its completion, the KDC will rival the most modern research facilities worldwide and will house some of the country's leading research programs associated with the neural and visual sciences, musculoskeletal disease and community health programs.

#### **Clinical Trials at UHN**

UHN researchers conduct up to 1,000 clinical trials each year. The broad base of clinical and research expertise and availability of supporting services makes UHN a centre of choice for conducting clinical trials. UHN researchers have full access to the Clinical Trial Support Unit (CTSU) – mandated to facilitate research involving patients – which provides a multitude of services including: clinical study coordination; correlative studies support; data safety monitoring board; lab space; mentoring and support and monitoring space and training.

**2009:** Katherine Siminovitch discovered a new genetic pathway (a gene 'road map') that could provide personalized treatment options for patients with a devastating liver disease. The study offers great hope in treating other autoimmune diseases such as rheumatoid arthritis.

## Partnering with UHN

The UHN Technology Development & Commercialization office ([www.uhnres.utoronto.ca/tdc/](http://www.uhnres.utoronto.ca/tdc/)) is responsible for fostering innovation and technology transfer at UHN. This office spearheads partnership activity by assessing and protecting intellectual property (IP) generated at UHN by commercializing IP through licensing or spin-off companies and by negotiating contracts and agreements on behalf of our researchers. UHN currently manages over 160 different patent families in areas including biomarkers, cancer metabolism, cell therapy, cancer stem cells, global health, depression, brain and spinal cord injuries, image-guided therapy, lung transplant, and nanotechnology.

## Recent Breakthroughs

- Cancer researchers Drs. Mitsuhiro Ikura and Vuk Stambolic (OCI) demonstrated that nuclear magnetic resonance (NMR) technology can be used to monitor changes in protein structure and activity in real-time.
  - With international collaborators, Drs. Katherine Siminovitch (TGRI) and Jenny Heathcote (TWRI) showed that changes in three specific genes are strongly associated with the risk of primary biliary cirrhosis.
  - Dr. Shaf Keshavjee (TGRI) and his team used gene therapy to repair previously unsuitable donor lungs for transplantation in human and animal models of end-stage lung disease.
  - In a clinical study of Parkinson's Disease, TWRI's Drs. Andres Lozano, Elena Moro, Jonathan Dostrovsky and William Hutchison discovered that deep-brain stimulation in a specific region of the brain helped to improve walking and other non-motor features such as rapid eye movement.
  - Drs. Pamela Ohashi and Tak Mak (OCI) devised a method to boost the body's immune system and direct it to specifically target cancer cells.
- Dr. Michael Tymianski (TWRI) and colleagues used gene therapy to selectively block a protein in the hippocampus region of the brain, effectively preventing irreversible brain cell death following stroke.

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**2009:** In an international collaborative study, investigators including Dr. Mark Silverberg discover five new regions in the genome associated with susceptibility to inflammatory bowel diseases (IBD) in children and adolescents. This is a major step toward understanding the causes of these diseases and the development of advanced drug therapies.

– The Samuel Lunenfeld Research Institute of Mount Sinai Hospital

# The University of Toronto



UNIVERSITY OF  
**TORONTO**

The University of Toronto is Canada's leading research-intensive university and one of the largest in North America. It has over 73,000 students, approximately 15,000 faculty and staff, and over 470,000 alumni worldwide. U of T's annual operating budget is over C\$1.4 billion and investigators attract research grant and contract support of C\$844.5 million per year.



**2002:** Dr. Steven Narod finds that there is a slightly higher risk of breast cancer for women who are BRCA gene carriers who take oral contraceptives before age 25 and for longer than five years.

– Sunnybrook Health Sciences Centre

There are three major U of T campuses that cover approximately 283.1 hectares of land. The university offers 168 graduate programs, 42 professional programs, and has 18 professional faculties. There are 10 fully affiliated teaching hospitals associated with the University of Toronto. The U of T library has more than 18 million volumes and is ranked fourth among North American university libraries, behind Harvard, Yale, and Columbia. Innovation has long been a hallmark at U of T.

During its 183-year history, the university has been home to some of the world's most original thinkers. Its graduates include two astronauts, four Canadian prime ministers, the first black Canadian doctor, the first Canadian aboriginal medical graduate and the world's first female aircraft designer. In addition, 10 Nobel Laureates were based at the University of Toronto at significant points in their careers. U of T innovation has led to the discovery of insulin and the development of the first electronic heart pacemaker, the artificial larynx, the single-lung transplant process, nerve transplants, and the artificial pancreas. Research at U of T has also led to the discovery of the genes responsible for cystic fibrosis and the most severe form of Alzheimer's disease.

#### **Core Technologies Include**

- Neuroscience
- Genomics and Proteomics
- Tissue Engineering/Biomaterials
- Regenerative Medicine
- Biopharmaceutical Discovery and Development
- Molecular Biology
- Computer Science and Bioinformatics

#### **Research Overview**

As the nation's top research university, U of T aims to push the frontiers of knowledge on all fronts.

## **Centre for Research in Neurodegenerative Disease (CRND)**

Through its Centre for Research in Neurodegenerative Disease (CRND), U of T provides international leadership in research, education and discovery related to neurodegenerative diseases, including Parkinson's and Alzheimer's disease. The CRND is an interdisciplinary research institute that brings together scientific expertise in Genetics, Molecular and Cell Biology, Protein Chemistry, Transgenic Animal Modeling, Neuropathology, Neuronal Function and Neuroimmunology.

## **Institute of Biomaterials and Biomedical Engineering (IBBME)**

U of T's Institute of Biomaterials and Biomedical Engineering (IBBME) is a unique multi-disciplinary organization where researchers and practitioners from applied science, engineering, medicine, dentistry, and biology collaborate to solve problems in a number of areas including medical and life sciences for the study of living systems, enhancement and replacement of those systems, design and construction of systems to measure basic physiological parameters, development of instruments, materials and techniques for biological and medical practice, and the development of artificial organs and other medical devices.

## **Banting and Best Diabetes Centre (BBDC)**

The Banting and Best Diabetes Centre (BBDC) has the primary objective of advancing diabetes research, education, and patient care. The BBDC boasts some of the world's most prolific innovators in the field of metabolic and endocrine disorders. In addition to these elite established

**1950s:** Introduction of lumpectomy for breast cancer.

– Dr. Vera Peters, University Health Network

programs, the university is currently developing major initiatives that have the potential to revolutionize biotechnology innovation in the coming years.

## **Molecular Design and Information Technology (MDIT)**

Opened early in 2003, the Molecular Design and Information Technology (MDIT) Centre, a high tech supercomputing facility, will form the heart of a new drug discovery and development program. This initiative designed to nurture and strengthen three-dimensional structure-based molecular research, biomolecular computations, and drug/molecular design. Along with the Faculty of Medicine's Institute for Drug Research (IDR), MDIT will cement the U of T community as an international hub for research in biopharmaceutical discovery and development.

## **Terrence Donnelly Centre for Cellular and Biomolecular Research (Donnelly CCBR)**

Opened in the fall of 2005, The Terrence Donnelly Centre for Cellular and Biomolecular Research (Donnelly CCBR) is establishing a unique organization to facilitate the development of novel and exciting technologies in the areas of medicine, arts and science and applied science and engineering. These technologies will have the potential to transform the current marketplace. The Donnelly CCBR will consist of five primary research platforms: (1) Animal Models of Disease, (2) Biomolecular Engineering, (3) Functional Imaging, (4) Protein Structure and (5) Proteomics and Bioinformatics.

## **Contact Information**

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**2000:** Robert Kerbel and his team show that much lower doses of chemotherapy in combination with antiangiogenic drugs (drugs that stop the development of blood vessels in tumours) will significantly delay tumour progression in animal models. Clinical trials are underway to validate these results in Ontario and around the world. If successful, this treatment would have less severe side effects than conventional treatments, and it could help to prevent drug resistance.

# Women's College Hospital



Women's  
College  
Hospital

Since we began in 1911, Women's College Hospital has been dedicated to a single goal: groundbreaking advances in women's health.



**1935:** Dr. John Ross studies lead poisoning in children, resulting in the prohibition of lead pigments in paints on children's toys and furniture.

– The Hospital for Sick Children

Just look at our track record. We opened the first cancer detection clinic in Ontario to screen healthy women for early signs of cancer. We were the first hospital in Ontario to use mammography. We led the invention of the Pap test and delivered the nation's first quintuplets. We established North America's first cardiac prevention and rehabilitation program designed exclusively for women. And the list goes on.

Today, we're continuing our legacy of innovation by doing what no other facility in Ontario has done. We're providing the most advanced care for women living with the diseases and conditions that affect them throughout their lives – diabetes, heart disease, arthritis, osteoporosis, mental illness, migraine and cancers. And we're doing it all without overnight hospitalization.

Integral to exceptional care is the pioneering research that underlies it. The Women's College Research Institute (WCRI) is committed to leading the world in women's health research. It is one of a few research institutes worldwide – and the only hospital-based one in Canada – to focus on women's health. It is home to a group of international leaders in women's health research with specialities including breast cancer, musculoskeletal health, and violence and trauma. Its faculty is extraordinarily productive – and growing fast in size and scope.

The need for a true centre for women's health has never been more profound. The reality is, there is a growing gap between the care traditional hospitals can provide and the care women need. That's because chronic conditions are increasing at unprecedented rates. Almost 80 per cent of Ontarians over age 45 have at least one chronic disease. Women are far more likely to have chronic conditions and more likely to have multiple conditions than men – often because women are living longer. And chronic illness is not

restricted to the elderly. Arthritis, rheumatism, cancers, asthma, depression, migraine and diabetes are affecting younger people at increasing rates.

Yet our health-care system is still designed to deal with acute problems. Problems that are short, urgent and potentially curable.

No longer. As Ontario's first academic ambulatory centre dedicated to women's health, both Women's College and its research institute are working to imagine and implement new approaches to care that foster prevention and disease management. Simply, we're looking to help women and their families live healthier and more independently with the conditions and diseases that affect them most. So we're providing surgeries, diagnostic procedures and treatments that get patients home within 18 hours. That means people can recover in the comfort of their own homes. And it means fewer risks, such as infection.

After a century of providing the most innovative research and care in women's health, Women's College Hospital is not slowing down. In fact, we're creating a hospital that delivers care in unprecedented ways. We're creating a hospital designed to keep people out of hospital. We're calling it the Hospital of the Future.

Visit [www.womenscolleghospital.ca](http://www.womenscolleghospital.ca) for a full listing of our programs and services.

## Contact Information

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# York University



York University is the leading interdisciplinary research and teaching university in Canada. York offers a contemporary academic experience at the undergraduate and graduate level in Toronto. The third largest university in the country, York is host to a dynamic academic community of 50,000 students and 7,000 faculty and staff, as well as 200,000 alumni worldwide.



**2009:** Dr. John Vincent and co-authors discover the gene involved in nonsyndromal intellectual deficit.

– Centre for Addiction and Mental Health

York's 10 faculties and 28 research centres and institutes conduct ambitious, groundbreaking research that cuts across academic boundaries. This distinctive and collaborative approach is preparing students for the future and bringing fresh insights to real-world challenges.

## York's Research Focus

York researchers undertake visionary research of local national and international significance. The knowledge they create provides insight into the scientific, economic, social and cultural issues affecting our world.

York researchers see with fresh eyes and new perspectives. Our research breaks down traditional academic boundaries and pursues truly interdisciplinary research projects, with a particular emphasis on collaborative projects between scientists, social scientists and external stakeholders. We engage colleagues at other institutions, across industries from non-government organizations and within community groups at the local, national and international level so that our approach is relevant to and has impact on the world in which we all live. York actively fosters knowledge exchange, technology transfer and community-university partnerships and clusters.

York has historical research strengths in areas such as vision science, space science, history and refugee studies. We are building on these strengths and expanding our interdisciplinary and collaborative research in strategic areas such as health research, the environment, climate change and sustainability, and digital media.

## Key Strategic Research Themes at York University

### Health Research

York's interdisciplinary approach to health research aims to improve the overall health and well-being of individuals and communities. With its Faculty of Health established in 2006, York has over 400 faculty members engaged in health research across the full spectrum of academic disciplines, along with 14 health-related research centres and facilities. In 2009, York was awarded a new Canada Research Chair (CRC) in muscle health, raising our total number of CRCs engaged in health research to 28 per cent.

In 2010, York opened the Sherman Health Research Centre, a leading-edge regional facility for vision science with specialized research facilities, such as brain-imaging, an fMRI platform, a virtual reality cave, EEG facility, visual and visuomotor assessment facility, and labs for the study of visual development. In 2011, the Life Sciences Building will add an additional 160,000 sq. ft. to our facilities, creating space for our growing demand for graduate and undergraduate programs in Life and Health Sciences, along with additional laboratory space for nuclear magnetic resonance, X-ray, mass spectrometry and radioisotope facilities.

### Research specializations include:

- Biotechnology, Mass Spectrometry, and Proteomics
- Vision Science — human perception, neurosciences, visual biometrics and computational vision
- Cancer — identifying markers for endometrial and head and neck cancer, ovarian cancer cell growth and tumour formation
- Infectious and Chronic Diseases
- Gender, Child, and Youth Health
- Health Systems, Policies, Law and

Management

- Muscle and Skeletal Health across the Human Life Cycle
- Social and Biomedical Determinants of Health
- Psychology
- Diabetes
- Nursing
- Kinesiology and Health Science

### **Environmental, Climate Change and Sustainability Research**

York's researchers seek solutions to a broad range of environmental issues and are leaders in environmental and sustainability research, working across diverse disciplines to address the most urgent issues facing our environment. Climate change's pervasiveness and complexity require a range of solutions that are grounded in social science, incorporate interdisciplinary and promote real-world responses.

To use climate change research strategically, we have partnered with the Toronto and Region Conservation Authority (TRCA) to lead the Climate Consortium for Research Action and Integration (CC-RAI) as part of our efforts to make substantial contributions to international and domestic climate science and policy processes. York is also leading an internationally collaborative project to study the challenge climate change presents to Canadian



employment and workplaces. Our researchers are also working with the Ministry of the Environment's Source Protection Planning branch to deliver climate adaptation programming and support key initiatives.

York's Faculty of Environmental Studies — the first faculty of its kind in Canada — comprises critical research in a wide array of areas, while the Institute for Research and Innovation in Sustainability (IRIS) supports leading sustainability-related research in areas that include atmospheric systems, urban environments, transportation, international development systems, and governance.

#### **Research specializations include:**

- Climate Change
- Air Quality, Atmospheric Science, and Pollution
- Energy Conservation
- Ecology and Conservation Biology
- Sustainable Agricultural, Fishing and Energy Industries
- Law and the Environment
- Geomatics
- Water Quality
- Globalization and Economic Competitiveness

#### **Digital Media Research**

Drawing on the breadth and scope of expertise in areas such as communications and cultural studies, fine arts, education, philosophy, computer science, engineering, applied mathematics, law, and business, York is emerging as a global leader in digital media research. This expanding strength reflects York's long-standing excellence in cultural and entertainment research.

#### **The Centre for Innovation in Information**

Visualization and Data-Driven Design features strong collaboration between York and the Ontario College of Art & Design University,

**1935:** Clinical use of Heparin as a blood thinner.

– Dr. Gordon Murray, University Health Network



along with some of Ontario's leading technology companies, including AMD, IBM, Open Text, Platform Computing, Side Effects Software, Autodesk, and Zameen Mobile. This project will leverage synergies at York between art and design, computer science and engineering, cognitive science, and learning technologies to develop the next generation of data discovery, design and visualization techniques by developing new computational tools, representational strategies, and interfaces.

The 3D Film Innovation Consortium (3D FLIC) is a two-year academic-industry partnership that will expand capacity for 3-D film production and technology in the Greater Toronto Area and Ontario. Teams of filmmakers at York, led by researchers in the Department of Film's Future Cinema Lab, will work with an array of



film industry partners to develop 3-D scenes and films. Vision researchers and psychologists in York's Centre for Vision Research and the Department of Psychology will then use this material to conduct tests exploring how humans perceive and process the images, which the filmmaking teams will use to further refine their films. This interdisciplinary cycle of research promises to develop practical solutions that will create better post-production technologies and processes for 3-D film production, which will benefit the film industry as a whole.

**Research specializations include:**

- 3-D Film and Stereoscopic Cinema
- Digital Media
- New Media
- Screen-Based Technologies
- Graphics and Animation
- Games, Gaming and Education
- The Arts, Culture, and Society
- Education and the Arts
- Computer Science and Emerging and Entertainment Technology

**York University Research Outreach and our Local Communities**

York's research also serves as a driver of economic growth and innovation in the Toronto region. York's strategic research plan include socio-economic policy as part of our overall innovation agenda, fostering partnerships between our researchers and the local and international community through technology and knowledge transfer, knowledge clusters, knowledge mobilization, regional innovation, and partnerships.

In 2010, Innovation York was launched to extend the university's S&T outreach by adding a central hub for innovation in York region, situated in a Convergence Centre in the Town of Markham. This hub will allow both industry and academic

sectors to address the innovation gap, aligning its purpose and effect with the Ministry of Research and Innovation's Innovation Agenda and the ONE strategy. It will accelerate commercialization and innovation by bringing together industry and our more entrepreneurial faculty and graduate students to optimize R&D opportunities.

### York University Facts

- With 5,200 graduate students, York has the second-largest graduate Faculty in Ontario.
- York is home to the world-renowned Schulich School of Business and Osgoode Hall Law School.
- Since 1999, York has graduated 1,220+ Doctoral, 14,150+ Master and 45,000+ Bachelor students.
- York has been ranked as Canada's third most internationally collaborative university in scientific research.
- York University's total impact on the Toronto region's economy was conservatively estimated at over \$3.5 billion in 2004.



### York's S&T-Related Research Centres & Institutes Centre for Atmospheric Chemistry

The Centre for Atmospheric Chemistry (CAC) is comprised of York scientists, working within the Departments of Chemistry and Earth and Atmospheric Science. The centre's research includes laboratory, field and computer simulation studies that further our fundamental understanding of chemical processes in the atmosphere. Research topics include urban and regional oxidation, aerosol formation, stratospheric ozone, acid precipitation, airborne toxic chemicals, global atmospheric change, and Arctic pollution.

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Website: [www.cac.yorku.ca](http://www.cac.yorku.ca)

### Centre for Research in Earth and Space Science

The Centre for Research in Earth and Space Science (CRESS) enhances and facilitates collaborative, interdisciplinary research on topics including astronomy and astrophysics, atmospheric dynamics, chemical physics, geodynamics, remote sensing, the space environment and robotics. It draws its members from the Departments of Earth and Space Science and Engineering, Physics and Astronomy, Chemistry, Computer Science and Engineering, and Mathematics and Statistics. CRESS engages in observations from space, from balloons and air craft, and from the ground, as well as in data analysis and modelling. It has extensive national and international collaborations and works closely with industry, government departments and the Canadian Space Agency.

Director: Jim Whiteway

Address: 249 Petrie Science Building

1988: Gene defect that causes Tay-Sachs disease identified.

– The Hospital for Sick Children

Phone: 416-736-5247  
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Website: www.cress.yorku.ca

### **Centre for Research in Mass Spectrometry**

The Centre for Research in Mass Spectrometry (CRMS) promotes mutually beneficial research collaboration in mass spectrometry both within and outside York University. Mass spectrometry is a very powerful analytical process that is used to identify unknown compounds, to quantify known compounds, and to elucidate the structure and chemical properties of molecules.

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Website: www.chem.yorku.ca/CRMS

### **Centre for Research on Biomedical Interactions (CRBI)**

The CRBI brings together researchers from the Departments of Chemistry and Biology, within the Faculty of Science and Engineering at York University, to further understanding of the mechanistic details of how biomolecules interact with one another, the relationship between biomolecular interactions and cellular processes, and how biomolecular interactions can be used to diagnose and treat diseases.

Director: Sergey Krylov  
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### **Centre for Vision Research**

The York Centre for Vision Research is an international leader in interdisciplinary studies of

vision, ranging from clinical applications, studies of human perception, brain sciences, visual biometrics, and computational vision, to helpful tools for the visually impaired, visually guided computer interfaces for the hearing impaired, and visually guided robots for the physically disabled.

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### **Institute for Research and Innovation in Sustainability**

The Institute for Research and Innovation in Sustainability (IRIS) is an interdisciplinary, university-wide institute that is the focal point for sustainability-related research activities by all 10 faculties. IRIS brings together and supports York academics and researchers to work across disciplines and collaborate with partners in Canada and internationally.

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### **Muscle Health Research Centre**

The Muscle Health Research Centre (MHRC) provides a centralized and focused research emphasis on the importance of skeletal muscle to the overall health and well-being of Canadians. Skeletal muscle, 40 per cent of a human's body mass, is a unique and large tissue that significantly contributes to an individual's metabolism, locomotion, and overall quality of life.

**2005:** Researchers map the molecular details that show how a viral protein coded in the Epstein-Barr virus immortalizes cells and causes them to continuously grow, thereby predisposing people to certain types of cancer.

– University of Toronto, Faculty of Medicine

Based in the Faculty of Health, the MHRC facilitates the integrated study of muscle biology in the broadest terms, including muscle development, disease, metabolism, blood supply, injury and regeneration, and adaptation to acute and chronic exercise. Approaches used by faculty and graduate students for the study of muscle include molecular, cellular and whole-body techniques.

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Web Site: [www.yorku.ca/mhrc](http://www.yorku.ca/mhrc)

### **York Core Molecular Biology and DNA Sequencing Facility**

The York Core Molecular Biology and DNA Sequencing Facility provides extensive service to the academic, biomedical, and biotechnology communities throughout Canada and the USA, offering DNA sequencing and proteomics science.

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Web Site: [www.yorku.ca/biocore](http://www.yorku.ca/biocore)

### **York Institute for Health Research**

The York Institute for Health Research (YIHR) promotes interdisciplinary health research. Comprised of faculty from law and the social, health, and environmental sciences, YIHR is based upon the assumption that health depends upon many interacting variables — social, political, economic, cultural and historical — and that without attention to these variables, efforts at intervention are likely to fail.

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**1971:** Canada's first successful surgical separation of conjoined twins takes place at HSC. Dr. B. Shandling led the team. There have been five surgical separations since then.

– The Hospital for Sick Children

# Toronto at a glance

	<b>TORONTO</b>	<b>REGION</b>
<b>POPULATION</b>	2,677,708	5,623,450
<b>LABOUR FORCE</b>	1,487,960	3,191,860
<b>UNEMPLOYMENT RATE</b> (ANNUAL AVERAGE)	9.99%	9.44%
<b>OFFICE SPACE FT2</b>	128,404,587	179,451,795
<b>INDUSTRIAL SPACE FT2</b>	290,003,852	838,296,518
<b>NUMBER OF BUSINESSES</b>	83,000	174,000
<b>GROSS DOMESTIC PRODUCT</b> (IN CURRENT \$BIL.)	\$138	\$263
<b>AVERAGE HOUSEHOLD INCOME</b>	\$90,603	\$95,812

Source: Statistics Canada, City of Toronto

## Competitive Advantage

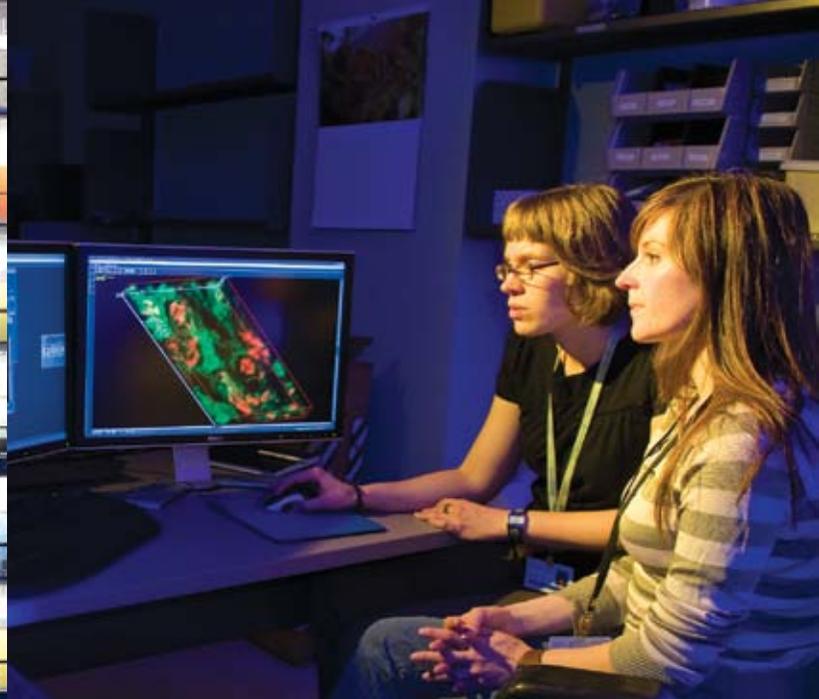
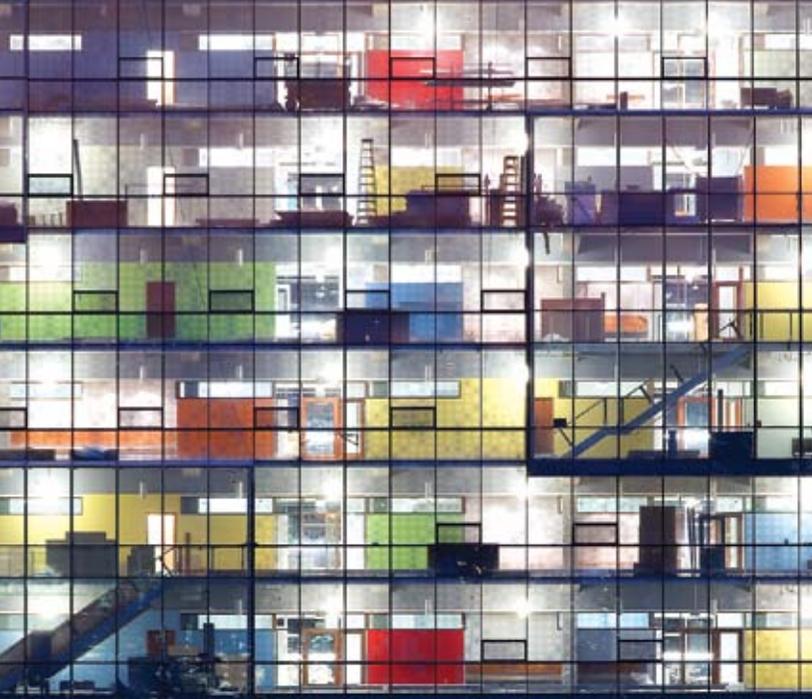
World Economic Forum has rated Canada's banks the soundest in the world for three consecutive years (2010)

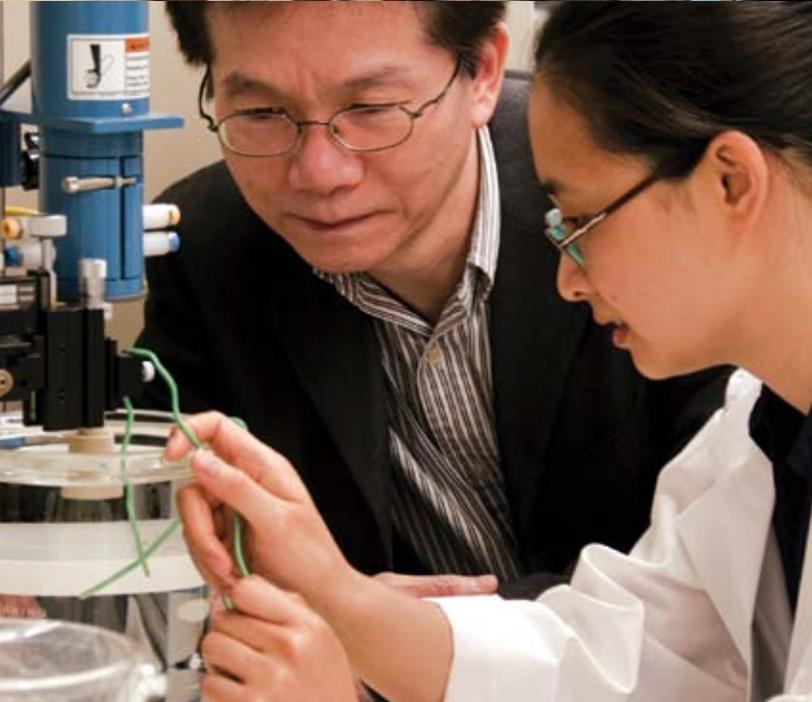
Canada is the 2nd easiest place in the world to start a business (World Bank Group, Doing Business Report 2010)

Toronto ranks 4th on the Economist Intelligence Unit's Most Livable Cities Index (2010)

Toronto ranks in the top 5 global cities with economic clout (PWC Cities of Opportunity Report 2010)

Toronto's vibrant cultural centre ranks it amongst the most diverse of cities. It is in the top 5 on The Economist Intelligence Unit's Most Liveable Cities Index (2010)







toronto at your service