

# Toronto's Discovery District



Innovation — Business — Technology



## Toronto's Discovery District Profile

### Table of Contents

	Page
• Introduction.....	5
• Toronto's Discovery District Quick Facts.....	6
• Toronto's Discovery District Map.....	7
• Frequently Asked Questions.....	8
• Toronto's Discovery District Research Advantage.....	9
• Toronto's Discovery District Cost Competitiveness.....	10
• Profiles of Leading Research Facilities.....	11
• Toronto's Discovery District Overview.....	12
• MaRS (The Medical and Related Sciences Centre).....	15
• The Samuel Lunenfeld Research Institute of Mount Sinai Hospital.....	16
• St. Michael's Hospital.....	18
• Sunnybrook and Women's College Health Sciences Centre.....	20
• The Hospital for Sick Children Research Institute.....	22
• University Health Network.....	24
• Ontario Cancer Institute.....	26
• Toronto General Research Institute.....	26
• Toronto Western Research Institute.....	26
• CAMH (The Centre for Addiction and Mental Health).....	27
• PET (Positron Emission Tomography Centre, CAMH).....	29
• University of Toronto.....	31
• Faculty of Nursing.....	33
• Faculty of Pharmacy.....	35
• CCBR.....	38





## Toronto's Discovery District "The Place to be in Biotechnology"

Healthcare is one of the fastest growing economic sectors in the world and such is the case, also, in Toronto. Toronto has one of the largest medical and biotech clusters of any metropolitan area in North America. More than \$800 million 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, from breast cancer and cardiovascular disease to Alzheimer's and cystic fibrosis. The biomedical clusters 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.

What is Toronto's Discovery District? It is a 2.5 square kilometre research park that is fully integrated into Toronto's down town core. It is probably the most concentrated mix of research, bio-medical companies, finance and business support services anywhere in the world. In the Discovery District lies one of the world's largest universities, one of the greatest concentrations of research institutions and teaching hospitals anywhere in the world and the seat of provincial government. Close by is Canada's financial and business centre – Bay Street, with expert advisors on legal, accounting and venture capital investment. Advisors who are well versed in the special needs of medical and biotechnology matters.

The Discovery District continues to grow... and to attract investment. More than \$500 million has currently been invested in new infrastructure that will support basic research and the commercialization of new scientific discoveries in the Toronto area. New tenant companies are now moving in to the completed first phase of the MaRS commercialization centre, 700,000 square feet of research labs, business incubator facilities and business services. Construction of the second phase, an additional 800,000 square feet, will commence very soon. Very close by is the new Donnelly Centre for Cellular and Bio-Molecular Research, a multi-story, \$110 million research centre and the new Leslie Dan Faculty of Pharmacy. These are part of a series of major capital investments that will continue to keep Toronto at the forefront of bio-medical 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 the Technology Transfer Officers at 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 you, as well. We have an expert team of specialists that can answer all of your questions about business and investment opportunities in our community. We also offer 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	Website: <a href="http://www.toronto.ca/business">www.toronto.ca/business</a>

## Toronto's Discovery District Quick Facts



- 2 square kilometres concentrated brain power
- More than 50,000 Jobs
- 22,000+ Medical Care and Research Related Jobs
- University of Toronto:
  - 67,000 Students
  - One of the Largest Faculties of Medicine in North America
  - More Medical Faculty and Students/Ph.D.s than Harvard
  - Medical Research Spending Ranked 4th in North America



- 9 Teaching Hospitals
- 30+ Specialised Medical and Related Sciences Research Centres
- Toronto's Biotechnology Sector ranks 4th in North America and in top 10 in the World
- Biotechnology Cluster is expected to grow by 30% annually
- Specialised Financial and Business Services Supporting the Research Community



- Biotechnology Specialisation in:
  - Vaccines
  - Diagnostics
  - Bio-Informatics
  - Bio- Pharmaceuticals
  - Biotech instrumentation
  - Genomics, Proteomics

# Toronto's Discovery District Map

**ED** Toronto  
Economic Development

**The Discovery District = Innovation + Technology + Business**

**Research Institutions:**

- 1 MARS (Medical and Related Science)
- 2 University Health Network (UHN)
- 3 Ontario Cancer Institute
- 4 Toronto General Research Institute (TGRi)
- 5 The Samuel Lunenfeld Research Institute at Mount Sinai Hospital
- 6 Prosserman Centre for Health Research
- 7 Centre for Systems Biology
- 8 Centre for Stem Cells & Tissue Engineering
- 9 Centre for Modeling Human Disease
- 10 Auxiliary Centre for Women's & Infants' Health
- 11 Fred A. Litwin Centre for Cancer Genetics
- 12 Centre for Genomics Medicine
- 13 Centre for Neurodevelopment and Cognitive Function
- 14 Centre for Addiction and Mental Health (CAMH)
- 15 CAMH Foundation
- 16 Positron Emission Tomography Centre (CAMH)
- 17 The Hospital for Sick Children Research Institute
- 18 The Advanced Protein Technology Centre (APTC)
- 19 The Centre for Applied Genomics (TCAG)
- 20 The Mouse Imaging Centre (Mico)
- 21 The Centre for Computational Micro (CCM)
- 22 The Clinical Research Centre (CRC)
- 23 University of Toronto - Medical School
- 24 Centre for Research in Neurodegenerative Disease
- 25 Institute of Biomaterials and Biomedical Engineering
- 26 Tissue Engineering
- 27 Photonics Research Ontario
- 28 Banting and Best Diabetes Centre
- 29 Molecular Design and Information Technology Centre (MDIT)
- 30 Joint Centre for Bioethics
- 31 Heart & Stroke / Richard Lewer Centre of Excellence for Cardiovascular Research
- 32 Sunnybrook & Women's College Research Institute
- 33 Women's College Hospital Ambulatory Care Centre
- 34 Centre for Research in Women's Health (CRWH)
- 35 The Joseph and Wolf Lobovici Centre
- 36 The Michener Institute for Applied Health Sciences
- 37 Canadian Arthritis Network
- 38 The Banting and Best Research Centre
- 39 Centre for Health Promotion
- 40 Leslie L. Dan Pharmacy Building
- 41 Terrence Donnelly Centre for Cellular and Biomolecular Research (CCBR)
- 42 Orthopaedic & Arthritis Institute
- 43 Baycrest Centre for Geriatric Care
- 44 Bloorview MacMillan Children's Centre
- 45 Toronto Western Hospital (TWH)
- 46 Toronto Western Research Institute (TWRI)
- 47 Vision Science Research Program
- 48 Playfair Neuroscience Unit
- 49 St. Michael's Hospital
- 50 Gene Therapy Program
- 51 Arthritis Society
- 52 Ryerson University
- 53 York University
- 54 Roberts Research Institute
- 55 Toronto Biotechnology Initiative
- 56 Ontario Cancer Research Network



**Biotechnology Companies:**

- a Arbit Biosciences Inc
- b ARiUS Research
- c Biosign Technologies Inc
- d Bone Inc Corp
- e CELLUTIONS Biosystems Inc
- f Chondro Gene Ltd
- g Dalton Chemical Laboratories Inc
- h Eli Lilly Specialties Inc
- i Ellipsis Biotechnology Corp
- j Genexx Biotechnology Corp
- k Hybrensis Ltd
- l IATRA Life Sciences Corp
- m Key Molecular Corp
- n Larral Proteomics Inc
- o MNE Motech Inc
- p Molecular Templates
- q Northern Therapeutics Inc
- r NPS Pharmaceuticals Inc
- s Orbital Biochemicals Inc
- t Remon Therapeutics
- u SensorChem International Corp
- v Serologicals Biomanufacturing Corp
- w Tm Biosciences Corp
- x Transition Therapeutics
- y Vasogen Inc
- z ZBX Corp
- aa

**Biomedical Companies:**

- ba Advanced Chemistry Development Inc
- bb Paracore Laboratories
- bc Footmaxx International Inc
- bd Innova Life Sciences Corp
- be Intraface Biologicals Inc
- bf MDS Sciez
- bg OBUS Forne Ltd
- bh Ophthalmic Technologies Inc
- bi Proctor Canada
- bj Serotech Laboratories Ltd
- bk Solutions by Sequence Inc
- bl Ventana Clinical Research Corp

**Pharmaceutical Companies:**

- ca Abbott Laboratories Ltd
- cb Aflinium Pharmaceuticals Inc
- cc Clera Inc
- cd Ellipsis Neurotherapeutics Inc
- ce Jamieson Laboratories
- cf Merck Frost Canada Ltd

## Frequently Asked Questions

### **What is the Toronto Discovery District?**

The Toronto 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. The Toronto's Discovery District is responsible for over \$500 million 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 the Toronto's Discovery District can be accessed from the technology transfer offices of the member institutions. (Contact information on the individual Discovery District members is available on the profile page.)

### **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 „Pablum“, the first scientifically designed baby food. More recent breakthroughs include the isolation of T-Cell and Dopamine receptors, and genes for muscular dystrophy, cystic fibrosis, Alzheimer's disease and breast cancer, to name but a few.

### **What are the opportunities and services provided?**

In-licensing/out-licensing and service opportunities abound. Please see the profile page as to the services provided to industry by the member institutions.

### **The federal and Ontario governments have initiated a number of incentive programs (ie. tax credits) to foster the development of a vibrant biotechnology industry. What are these incentive programs and how do they assist industry in reducing the cost of conducting research in Ontario?**

Conducting research within the Toronto Discovery District can reduce your research costs by up to 66%. Speak with any member institution representative and find out how partnering within Toronto's Discovery District can help you.

## Toronto's Discovery District Research Advantages

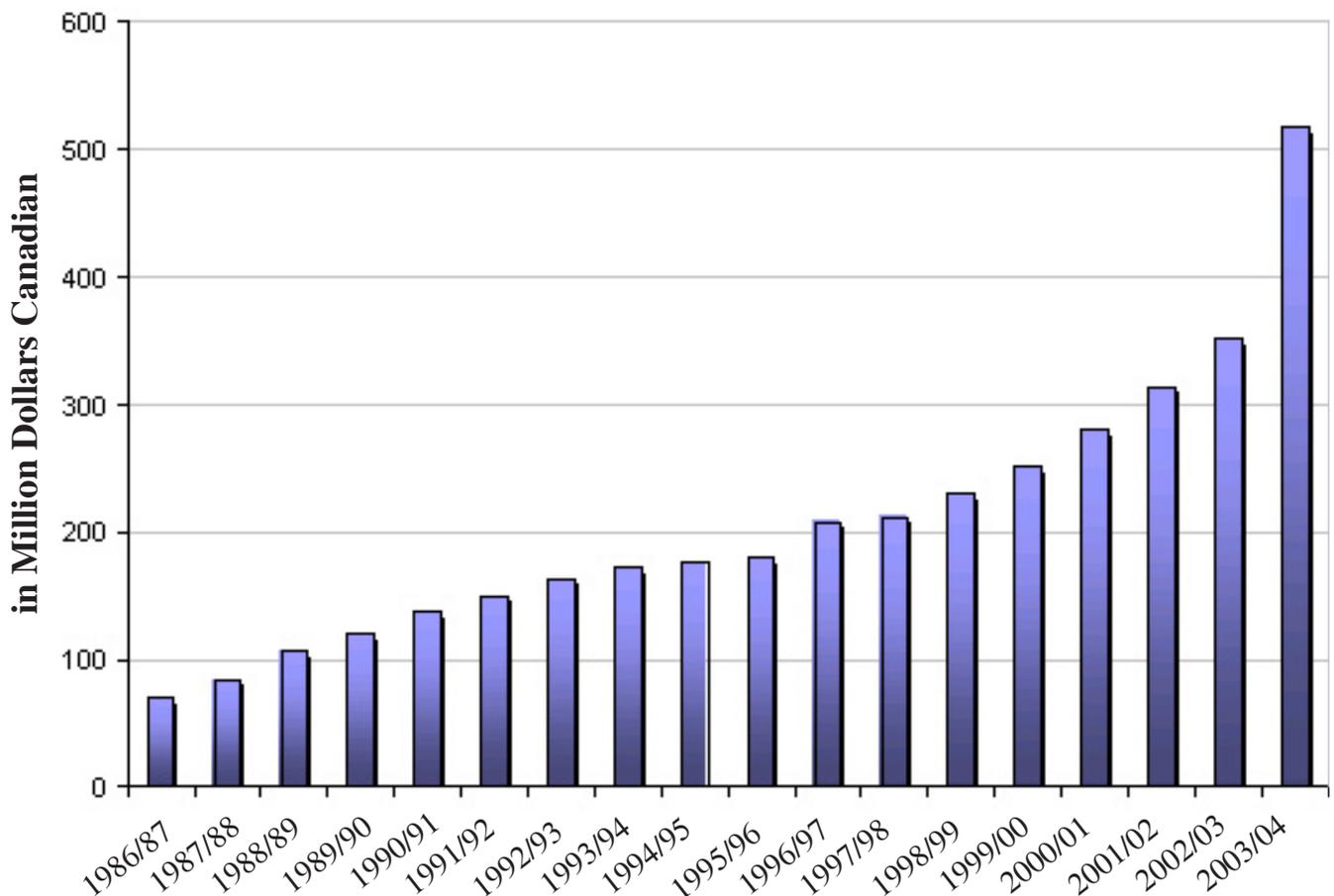
- University of Toronto- One of the Largest Faculties of Medicine in North America
- More Medical Faculty and Students/Ph.D. than Harvard
- Medical Research Spending Ranked 4th in North America
- More than \$800 Million Funding for Medical Research in 2004

### Medical Faculty Overview

	U of T Medical
Medical Students	766
Ph.D. Students	822
Faculty	4936
Affiliated Hospitals/ Research Centres	20

(Source: University of Toronto, 2003)

### University of Toronto Research Public Funding Faculty of Medicine Affiliated Research Institutes



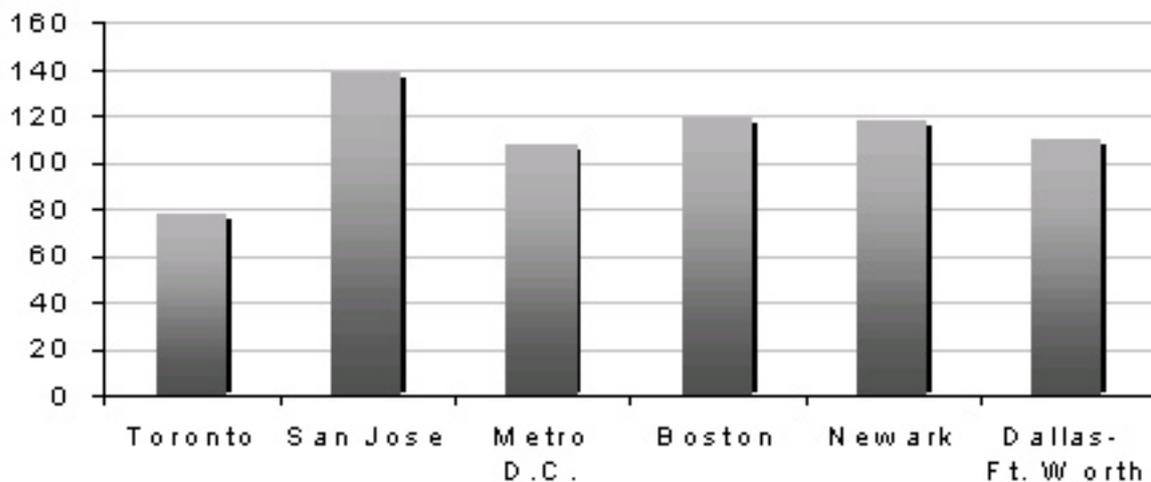
## Toronto's Discovery District Costs Competitiveness

### Research and Technology Commercialization are supported by significant Financial Incentives

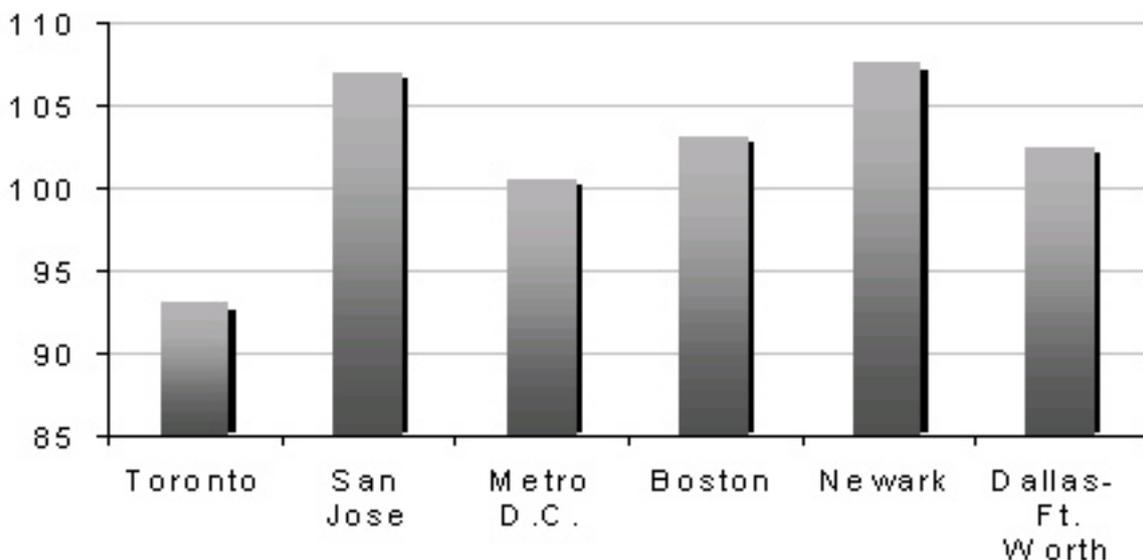
- A company spending \$100 on R&D can earn a tax credit that can reduce costs to \$35.45
- Ontario, in partnership with the Government of Canada, offers a world-leading tax credit system for research and development
- Companies receive 100% deduction of qualifying R&D expenditures plus a 20% investment tax credit on those expenditures to apply against income
- A "superallocation" offers an additional 25 to 52.5% on taxable income

### Toronto Offers a Very Cost Competitive Environment for Research and Investment

#### Average Biomedical R & D Costs



#### Average Pharmaceutical Manufacturing Costs



# Toronto's Discovery District



Innovation – Technology - Business

- Profiles of Leading Research Facilities -

## Toronto's Discovery District Overview

### University of Toronto Affiliated Major Research Institutes

Research Institute	Centre for Addiction and Mental Health (CAMH)	The Hospital for Sick Children Research Institute	St. Michael's Hospital
<b>Research Areas</b>	Neuroscience Research (including Molecular Biology, Biochemistry, Pharmacology, Genetics, Epigenetics & Biobehavioural research); Clinical Research (including Schizophrenia, Mood Disorders, Addictions, Psychiatric & Instrument Development); Social Prevention and Health Policy Research (incl. Women's Health, Culture, Community & Health, Health Systems and Epidemiology Research)	Brain & Behaviour Research; Cancer Research; Cardiovascular Research; Cell Biology; Developmental Biology; Genetics and Genomic Biology; Infection, Immunity, Injury, & Repair Research; Integrative Biology; Lung Biology; Metabolism Research; Population Health Sciences; Structural Biology and Biochemistry	Inner City Health; Critical Care; Global Health
<b>No. of Principal Researchers</b>	150	404	153
<b>No. of Trainees</b>	161 (57 Fellows; 104 Students)	752	174
<b>No. of Support Staff</b>	322 (incl. Res. Analysts, Ass't, Coordinators; techs, admins, mgmt, etc.)	947	323
<b>Research Budget</b>	\$5 million	\$127 million, fiscal 2004/2005	\$30.2 million, fiscal 2003/2004
<b>No. of Clinical Trials</b>	37	1700 active clinical protocols	350 submitted in 2004
<b>Special Facilities</b> (Those available for both academic and commercial research use indicated by *)	*Positron Emission Tomography (PET) Centre *Transgenic Centre *PRIME Clinic (Prevention through Risk Identification, Management and Education) *Confocal Microscopy Centre *Epigenetics Laboratory	*The Advanced Protein Technology Centre (APTC) <a href="http://www.sickkids.ca/APTC/">http://www.sickkids.ca/APTC/</a> *The Centre for Applied Genomics (TCAG) <a href="http://tcag.bioinfo.sickkids.on.ca">http://tcag.bioinfo.sickkids.on.ca</a> *The Mouse Imaging Centre (MICe) <a href="http://mouseimaging.bioinfo.sickkids.on.ca">http://mouseimaging.bioinfo.sickkids.on.ca</a> * Ontario Centre for Genomic Computing <a href="http://ocgc.ca">http://ocgc.ca</a> * Clinical Research Centre	* Research Ethics Monitoring * Bioimaging Centre * Biostatistical Consulting
<b>More Information</b>	Page 27	Page 22	Page 18

## Toronto's Discovery District Overview

### University of Toronto Affiliated Major Research Institutes

		Sunnybrook & Women's College Health Sciences Centre	
Research Institute	The Samuel Lunenfeld Research Institute at Mount Sinai Hospital	Sunnybrook & Women's College Research Institute	Centre for Research in Women's Health
<b>Research Areas</b>	Proteomics; Bioinformatics; Cell signaling; Functional genomics; Model Organism (mouse, yeast, C. elegans); Cancer Genetics; Women's & Infant's Health; Stem cells & Tissue engineering; Translational research; Infectious disease; Gastrointestinal disease	<p><b>Research disciplines:</b> clinical epidemiology, clinical integrative biology, imaging and molecular and cellular biology</p> <p>These disciplines support research in these <b>strategic programs:</b> cancer, community and population health, heart and circulation, musculoskeletal, neurosciences, perinatal and gynecology, and trauma and critical care. A focus on aging and women's health runs throughout.</p>	Cancers common in women, mental health, reproductive health, gender violence (treatment, prevention and intervention), reproductive health, osteoporosis and arthritis, global health, perinatal health promotion, chronic conditions, disability and body image
<b>No. of Principal Researchers</b>	85	177	35
<b>No. of Trainees</b>	231	147	35
<b>No. of Support Staff</b>	60	264	50
<b>Research Budget</b>	\$60 million, fiscal 2003/2004	\$85.5 million, fiscal 2004/2005	\$4.4 million, fiscal 2004/2005
<b>No. of Clinical Trials</b>	250 new studies / year	\$4.6 million fiscal 2004/2005	\$700,000 per annum
<b>Special Facilities</b> (Those available for both academic and commercial research use indicated by *)	<ul style="list-style-type: none"> <li>* Centre for Modeling Human Disease</li> <li>* Mass Spectrometry</li> <li>* GLP Clinical Laboratories</li> <li>* Robotics &amp; high throughput assays</li> <li>* Micro array facility</li> </ul>	<p><b>Core Facilities:</b></p> <ul style="list-style-type: none"> <li>- Centre for Cytometry and Scanning Microscopy</li> <li>- Imaging: 1.5T Research MRI</li> <li>- Imaging: 3T Research MRI</li> <li>- Proteomics</li> <li>- Histology Laboratory</li> <li>- Genomics</li> <li>- Antibody Core Facility</li> <li>- Transgenic and Gene Targeting Facility</li> </ul> <p><b>Venture Funds:</b></p> <ul style="list-style-type: none"> <li>- Sunnybrook Working Ventures Medical Breakthrough Fund</li> <li>- Medical Ventures Fund</li> </ul>	
<b>More Information</b>	Page 16	Page 20	Page 20

## Toronto's Discovery District Overview

### University of Toronto Affiliated Major Research Institutes

Research Institute	University Health Network		
	Toronto General Research Institute	Ontario Cancer Institute and Advanced Medical Discovery Institute	Toronto Western Research Institute
<b>Research Areas</b>	Behavioural Science and Health; Cell & Molecular Biology; Clinical Decision Making and Health Care; Clinical Investigation and Human Physiology; Experimental Therapeutics; Genomics Medicine; Clinical Studies	Applied Molecular Oncology; Biophysics and Bioimaging; Cancer Genomics and Proteomics; Epidemiology, Statistics and Behavioural Research; Signaling Biology; Stem Cell and Developmental Biology; Clinical Studies	Musculoskeletal Health & Arthritis; Neural & Sensory Science; Applied and Interventional Research; Cell and Molecular Biology; Outcomes & Population Health; Clinical Studies
<b>No. of Principal Researchers</b>	188	146	132
<b>No. of Trainees</b>	327	387	137
<b>No. of Support Staff</b>	435	455	193
<b>Research Budget</b>	Data for all 3 UHN Research Institutes: > 160 million for 2004/ 2005		
<b>No. of Clinical Trials</b>	>\$11 million in Clinical Trials		
<b>Special Facilities</b> (Those available for both academic and commercial research use indicated by *)	<ul style="list-style-type: none"> <li>* Analytical Genetics Technology Centre (AGTC) (<a href="http://www.analyticalgenetics.ca">www.analyticalgenetics.ca</a>)</li> <li>* Microarray Centre (MAC) (<a href="http://www.microarray.ca">www.microarray.ca</a>)</li> <li>* DNA Sequencing Facility (<a href="http://www.uhnresearch.ca/facilities/sequencing.htm">www.uhnresearch.ca/facilities/sequencing.htm</a>)</li> <li>* Proteomics Group (<a href="http://www.uhnres.utoronto.ca/proteomics">www.uhnres.utoronto.ca/proteomics</a>)</li> <li>* Global eHealth (<a href="http://www.ehealthinnovation.org">www.ehealthinnovation.org</a>)</li> <li>* Flowcytometry</li> <li>* Advanced Optical Microscopy Facility (AOMF) (<a href="http://www.uhnres.utoronto.ca/omm/aomf">www.uhnres.utoronto.ca/omm/aomf</a>)</li> <li>* Laboratory for Applied Biophotonics (<a href="http://www.uhnresearch.ca/facilities/LAB.htm">www.uhnresearch.ca/facilities/LAB.htm</a>)</li> <li>* TGRI Light Microscopy Unit</li> <li>* Wright Cell Imaging Facility (<a href="http://www.uhnresearch.ca/wcif">www.uhnresearch.ca/wcif</a>)</li> <li>* Sterilization Services (<a href="http://www.uhnresearch.ca/facilities/sterilization.htm">www.uhnresearch.ca/facilities/sterilization.htm</a>)</li> <li>* Tissue Culture Media Facility (<a href="http://www.uhnresearch.ca/facilities/temf.htm">www.uhnresearch.ca/facilities/temf.htm</a>)</li> </ul>		
<b>More Information</b>	Page 24	Page 26	Page 26

### Overview



“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

### 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 and technology innovation. MaRS connects and fosters collaboration between the communities of science, business and capital through co-location in the MaRS Centre and more broadly through catalytic programs, structured networks and the MaRS web portal. MaRS will ensure that made-in-Canada discoveries make a positive difference to the health and quality of life of Canadians and others around the world. The MaRS Centre, located in Toronto’s Discovery District, opened in May 2005.

### MaRS Centre



MaRS Centre is a convergence innovation centre in the heart of Toronto’s world renowned “Discovery District” that connects the leadership in science, business and capital to create a more efficient commercialization marketplace in Canada. Phase One is already 90% pre-leased with a strategic mix of over 50 companies and organizations comprising leading researchers and technology transfer groups, growth businesses ranging from start-ups to mature companies, venture capital and professional services firms, and community organizations.

The MaRS Centre also houses: the MaRS Incubator, a state-of-the-art incubation facility for young companies; the MaRS Entrepreneurship Centre, a resource centre for entrepreneurs, technology start-ups and emerging growth companies; and the MaRS Collaboration Centre, a high-tech auditorium for delivering MaRS Programs and hosting community events. MaRS extends the benefits of the Centre virtually through the MaRS Portal – an online community connecting commercialization stakeholders from across the province and beyond.

Phase Two of the development will see MaRS building out another 800,000 square feet, with a target completion date of 2008. It is anticipated that the momentum of the MaRS project will attract multinational technology businesses and leading research organizations to this development.

### Contact Information

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Fax: 416-673-8181  
Website: [www.marsdd.com](http://www.marsdd.com)

## The Samuel Lunenfeld Research Institute (SLRI) of Mount Sinai Hospital



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 leading centres in biomedical research. The Institute is committed to excellence in health research and the training of young investigators. Strong partnerships with industry and the clinical programs of Mount Sinai Hospital ensure that scientific knowledge is used to promote human health. Research programs are focussed in a number of cross-disciplinary centres. The goal of these eight interrelated programs is to understand the function of our genes and how genetic pathways and environmental factors lead to the development of human diseases such as cancer, diabetes, hypertension, premature labour, depression and osteoporosis. Our approach at the Lunenfeld allows for the application of biomedical research from molecules to populations.

### **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 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 ES 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 Genomic Medicine**

Researchers in the Centre for Genomic Medicine conduct translational research – the development of strategies and mechanisms to accelerate the application of advances and knowledge in fundamental science to clinical practice expediting 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 cognisant of advances in fundamental science and capable of applying them to clinical issues.

### **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.

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

Research in the Auxiliary Centre for Women's and Infants' Health is focussed 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 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 includes: 1) studying the fundamental signal transduction cascades and other molecular machineries that govern the development of single neurons to the mammalian brain; 2) establishing the molecular mechanisms that initiate and regulate the formation of connectivities among the developing neurons; 3) analyzing the function of neural circuits in different animal behaviors; and 4) establishing animal models to study the cause and cure for human neurological and psychiatric diseases.

#### **Contact Information**

**Terry Donaghue**, Director, Technology Transfer&Industrial Liaison

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## St. Michael's Hospital



St Michael's Hospital has identified three areas of research focus which not only build on its existing strength but also fill gaps in the research community in Ontario. At no other institution is there a defined emphasis and committed resources in support of research in Critical Care, Inner City Health and Global Health. These research areas link with St. Michael's clinical and research expertise, and represent areas of need in the community we serve, both locally and internationally.

We have over 140 physician investigators and over 200 new research protocols a year. Our cutting edge translational research has also led to spin-off companies in areas of our specialization. For example, our cardiac gene therapy program has already led to a spin-off company targeting pulmonary hypertension, an often fatal disease affecting relatively young individuals.

### **Critical Care Research**

Critical Care as a research thrust was born out of the existing strengths of researchers at SMH in cardiology, nephrology, diabetes, respirology and neurotrauma, and has been expanded over the past five years to include research platforms with direct relevance to the most severely ill patients within those disease specific areas.

However, "critical care" within this context encompasses far more than just activities directly related to the intensive care unit, and includes research on mechanisms and novel therapies for acute organ dysfunction from the heart to the brain, and addresses the needs of patients with multiple organ system failure due to disease or injury which is commonly associated with high mortality rates.

The research themes within critical care research fall under the categories of "repair" (regenerative medicine), "injury" (injury and inflammation) and "discovery" (molecular and genetic determinants of disease).

### **The Centre for Research on Inner City Health**

The Centre for Research on Inner City Health has been well-recognized over time as being a unique program that caters to a niche research area. The multidisciplinary centre conducts transdisciplinary research in the area of marginalized populations.

Over the last year, the Centre has initiated policy forums for the discussion and transfer of evidence based knowledge. The goal is to inform decision makers and stakeholders about the outcomes of current policy and provide input on new and changing policies, specifically dealing with the health of marginalized populations. Major research areas include: healthcare utilization among homeless population, suicide prevention, clinical outcomes research, nutrition and environmental factors affecting the inner city population.

## Centre for Global Health Research



Dr Prabhat Jha is the Director of the Centre for Global Health Research. The Centre's research encompasses several large-scale, international projects in the area of marginalized populations across the world. The mission of the Centre is, "to conduct high-quality epidemiological research that advances global health." Specific emphasis is on avoidance of two large and growing causes of death worldwide - - HIV-1 and tobacco. By conducting research in these areas it is possible to yield a positive impact on marginalized populations across the world. This type of activity continues to advance the mission of SMH "to care for the sick and the poor," both in our neighbourhoods and across the globe. The intended result of this work is to inform

policy makers in other countries on how to create policies and programs that will allow proactive steps to be taken to manage and potentially minimize these issues and diseases from large populations.

### Contact Information

#### **Mark Robson**

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Website: [www.stmichaelshospital.com](http://www.stmichaelshospital.com)

## Sunnybrook and Women's College Health Sciences Centre



Sunnybrook and Women's College Health Sciences Centre, one of Canada's premier academic health sciences centres, is transforming health care through the dedication of its more than 10,000 staff members and volunteers. Sunnybrook & Women's specializes in providing women's health programs, caring for Canada's war veterans,

conducting leading-edge research and teaching the latest advances in health care through its affiliation with the University of Toronto. Sunnybrook & Women's improves the lives of hundreds of thousands of people each year by caring for newborns, adults and the elderly, and by treating and preventing cancer, heart and circulation diseases; disorders of the brain, mind and nervous system; orthopaedic and arthritic conditions; and traumatic injuries.

In its relatively short 15-year history, Sunnybrook & Women's Research Institute (SWRI) has grown to become one of Canada's largest research institutes. Since 2000, research expenditures have more than tripled. In 2004/2005, external research funding approached \$75 million. Across 250,000 square feet spanning three campuses, 177 scientists, 147 trainees and more than 250 laboratory and other core staff members are working together to solve the most pressing problems in medical sciences research today.

Scientists working along the continuum of discovery—from basic science to translational research to knowledge transfer—are endeavouring to understand and prevent disease and develop diagnostics and treatments that enhance and extend life. Research and clinical teams collaborate closely to achieve their shared aim of discovery and its accelerated translation into the clinic to improve the care of patients and define the next set of best practices.

Research at SWRI truly is multidisciplinary and translation-focused. All scientists belong to a discipline—clinical epidemiology, clinical integrative biology, imaging, or molecular and cell biology—that provides the platform for research within a strategic clinical program—cancer, community and population health, heart and circulation, musculoskeletal, neurosciences, perinatal and gynaecology, or trauma and critical care.

SWRI's research partners include the Centre for Research in Women's Health, a joint venture between Sunnybrook & Women's and the University of Toronto, and the Institute for Clinical Evaluative Sciences (ICES), an independent non-profit organization funded by the Ministry of Health and Long-Term Care. ICES uses population-based information to produce knowledge on health care issues. Many scientists in clinical epidemiology at SWRI work at ICES.

One of SWRI's primary industry partners is sanofi pasteur, Canada's largest vaccine company. It sponsors research at SWRI through its Cancer Vaccine Network, which Industry Canada's Technology Partnerships Program also supports. SWRI was also one of the first research institutes in Canada to launch an early-stage venture capital fund with a major venture capital firm, and it recently participated in executing a second fund.

SWRI continues to invent the future of health care. Over the past five years, SWRI has achieved important and innovative advances and breakthroughs, a sample of which follows:

- Imaging scientists 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.
- Cancer scientists showed that lower doses of chemotherapy given with antiangiogenic drugs significantly delays the growth of tumours in animal models, a molecular breakthrough that clinical trials teams worldwide are now seeking to validate.
- Immunologists discovered a protein in breast milk that stimulates the immune system of newborns, thereby providing a means to enrich baby formula with a supplement that delivers immune system benefits similar to those offered by breast milk.
- Scientists in molecular and cellular biology created a system to generate T cells in a Petri dish. This points to future clinical therapies for people with devastated immune systems.
- Scientists discovered a molecular marker to diagnose the most common type of liver cancer, which led to the development of a diagnostic test.
- Scientists in clinical integrative biology discovered a way to make the immune system specifically recognize infectious prions, thereby paving the way for the development of diagnostic tools, immunotherapy and a vaccine.
- A multidisciplinary research team found magnetic resonance imaging detects more breast cancer tumours, earlier, compared with mammography, ultrasound or clinical examination in women with the BRCA1 and BRCA2 genes.
- Heart and circulation researchers showed that artery grafts from the forearm should be used in place of vein grafts from the leg in heart bypass surgery, because radial arteries have significantly higher graft patency, which is crucial to a good outcome.

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## Sick Kids The Hospital for Sick Children Research Institute

**SickKids**



The Hospital for Sick Children (SickKids) is the largest paediatric academic health sciences centre in Canada. Its central mission is to deliver exemplary patient care and to develop new interventions and treatments. The synergy between the SickKids Research Institute and its patient-care professionals leads to breakthroughs in treatment and ultimately, prevention of childhood disease and injuries.

The SickKids Research Institute was established in 1954. However, research at the hospital began in 1918 with the development of the Nutritional Research Laboratory, where Pablum was developed in 1930. Today, the Research Institute houses a full spectrum of research, from bench to bedside, brought to bear on problems of children's health.

Currently, there are approximately 2,000 staff and trainees involved in more than 900 funded research projects, including more than 1,800 active clinical protocols, in the Research Institute. Along with the 404 researchers, there are approximately 750 graduate students, research fellows, and visiting scientists from at least 25 countries, as well as laboratory technologists, assistants and other support staff.

The total Research Institute budget for 2004-2005 was more than \$125 million. Funding for research activities and operations comes from two sources: Internal funding from SickKids Foundation, where community and corporate donors contribute to the Foundation's endowments that fund this annual grant; and external funding from approximately 750 peer-reviewed grants awarded to our researchers. In addition, the SickKids Research Institute has approximately 190 collaborative research projects with pharmaceutical and biotechnology companies.

Research at The Hospital for Sick Children is organized into 12 research programs: Brain & Behaviour Research, Cancer Research, Cardiovascular Research, Cell Biology, Developmental Biology, Genetics & Genomic Biology, Infection, Immunity, Injury & Repair Research, Integrative Biology, Lung Biology, Metabolism Research, Population Health Sciences, and Structural Biology & Biochemistry.

### **SickKids research facilities include:**

- The Advanced Protein Technology Centre (APTC) provides protein research services including amino acid analysis, peptide sequencing and synthesis, and mass spectrometry.
- The Centre for Applied Genomics (TCAG) provides services for human genome and disease research, including gene and physical mapping services, DNA sequencing, DNA synthesis, genetic analysis, gene isolation and expression and uses microarray technology.

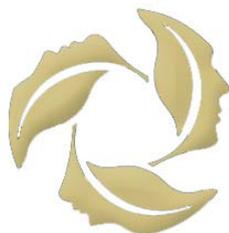
- The Mouse Imaging Centre (MICe) is a unique resource combining the latest digital imaging technologies for the characterization of mouse functional genomics. The imaging equipment is able to study the mouse at all stages of life. Most of the studies can be performed in vivo, allowing for time-course studies in individual mice.
- The Centre for Computational Biology (CCB) provides state-of-the-art computing facilities, applications and databases, including an SGI Origin 3800 supercomputer.
- The Clinical Research Centre (CRC) facilitates the conduction of physiological types of patient-based research. CRC is comprised of four units: an exercise laboratory, biomedical engineering, a metabolic research kitchen, and the Clinical Investigation Unit.

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### University Health Network



UHN Research ([www.uhnresearch.ca](http://www.uhnresearch.ca)) is a leading-edge biomedical and healthcare research organization with international stature, and is a teaching partner of the University of Toronto. Our research institutes (Ontario Cancer Institute, Toronto General Research Institute and Toronto Western Research Institute) are home to nearly 500 scientists and clinician scientists, and more than 1900 staff and trainees.

In 2004/2005 UHN Research had a research budget of \$160M. Our researchers lead programs in cancer, cardiology, transplantation, immunology and autoimmunity, infectious diseases, tissue injury, diabetes, neural and visual sciences, musculoskeletal disease, and urban and community health. UHN Research brings together the innovation, talent and resources to achieve global impact in basic, translational and clinical research.

#### UHN Research 2004-2005 Statistics

- Nearly 500 scientists and clinician scientists
- Research funding C\$160 M
- Clinical studies/contracts C\$20.8M
- Total external funding C\$128.6M
- Funding from over 400 Canadian and international research grant agencies, foundations as well as from companies in pharmaceutical and biotechnology sectors

#### State of the art facilities

- Analytical Genetics Technology Centre (AGTC) ([www.analyticalgenetics.ca/](http://www.analyticalgenetics.ca/))
- Microarray Centre (MAC) ([www.microarrays.ca](http://www.microarrays.ca))
- DNA Sequencing Facility ([www.uhnresearch.ca/facilities/sequencing.htm](http://www.uhnresearch.ca/facilities/sequencing.htm))
- Proteomics Group ([www.uhnres.utoronto.ca/proteomics](http://www.uhnres.utoronto.ca/proteomics))
- Global eHealth ([www.ehealthinnovation.org](http://www.ehealthinnovation.org))
- Flowcytometry
- Advanced Optical Microscopy Facility (AOMF) ([www.uhnres.utoronto.ca/omm/aomf](http://www.uhnres.utoronto.ca/omm/aomf))
- Laboratory for Applied Biophotonics ([www.uhnresearch.ca/facilities/LAB.htm](http://www.uhnresearch.ca/facilities/LAB.htm))
- TGRI Light Microscopy Unit
- Wright Cell Imaging Facility ([www.uhnresearch.ca/wcif](http://www.uhnresearch.ca/wcif))
- Sterilization Services ([www.uhnresearch.ca/facilities/sterilization.htm](http://www.uhnresearch.ca/facilities/sterilization.htm))
- Tissue Culture Media Facility ([www.uhnresearch.ca/facilities/tcmf.htm](http://www.uhnresearch.ca/facilities/tcmf.htm))

### **Clinical Trials at UHN**

UHN Research capabilities are matched by Canada's largest hospital, encompassing expertise in cancer care (Princess Margaret Hospital); cardiovascular science and transplantation (Toronto General Hospital) and neural and sensory sciences, musculoskeletal health and arthritis, and community and population health (Toronto Western Hospital). The broad base of clinical and research expertise and availability of supporting services makes UHN a centre of choice for conducting clinical trials. Clinical Studies Resource Centres are available at each hospital to facilitate the design and implementation of clinical trials.

### **UHN Clinical 2004-2005 Statistics**

- 707 beds
- 29,928 inpatient cases
- 949,511 clinical visits
- C\$1.04B annual budget
- Over C\$11M in Clinical Studies

### **Partnering with UHN**

The UHN Research Business Development Office ([www.uhnresearch.ca/rbdo](http://www.uhnresearch.ca/rbdo)) has been responsible for fostering innovation and technology transfer at UHN since 1998. This eight member 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.

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### **Ontario Cancer Institute (OCI)**



Established in 1952, the Ontario Cancer Institute is one of the leading centres for the study of the molecular basis of cancer. 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.

### **Toronto General Research Institute (TGRI)**



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)**



TWRI is home to the research programs associated with the neural and sensory 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. Researchers at musculoskeletal research program focus on arthritis and associated degenerative diseases. Their investigations are aimed at revealing the causes of, and generating therapies for, these ailments.

## The Centre for Addiction and Mental Health (CAMH)



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

The Centre for Addiction and Mental Health (CAMH) was created in 1998 and is the largest Mental Health and Addiction treatment facility in Canada. The centre's mandate to be a leader in providing better understanding, prevention and care to those affected by mental illness and addictions is the key element responsible for creating a fully integrated research program.

Further, the centre has a mandate to work with its many partners to provide treatment, health promotion/prevention, research and education, locally, regionally and provincially. The centre is fully affiliated with the University of Toronto and is recognized as a Pan American Health Organization/World Health Organization Collaborating Centre.



The research program at the centre is structured into 3 departments: Neuroscience, Clinical Research and Social, Prevention and Health Policy Research. The structure of this program embodies the Centre's Bench to Bedside to Community philosophy of research. The research program aims to promote the research, treatment and education goals of the centre by supporting the work of those who produce new knowledge and by promoting the transfer of such knowledge to evidence-based practice and the community at large. To this end, we have initiated and supported a variety of projects, both within and between departments.

CAMH's profile - over 150 principal investigators, 161 trainees (graduate students, postdoctoral fellows, summer students, under-graduate students and volunteers); over 100,000 sq. ft research space, annual extramural funding \$ 20,629,954 (2003/2004).

The centre's research initiatives continue to play a critical role in revolutionizing our understanding and approaches to prevention and care in the fields of mental health and addiction. CAMH is in a unique position to bring together internationally recognized neuroscientists, clinical and social scientists and to offer state-of-the-art facilities, a range of professional training and a province-wide network of community program staff. The centre benefits from state-of-the-art, in-house research facilities. These facilities include the Positron Emission Tomography (PET) Centre, which is currently equipped with the most sophisticated 3D PET camera in the world as well as a mouse transgenic facility used to develop new genetic models relevant to addiction and mental health research.

The centre's research initiatives integrate addiction and mental health research from neuroscience, clinical research and social, policy and prevention perspectives.

**The Neuroscience Research Department focuses on neurobiological mechanisms underlying mental illness, addiction and their respective treatments. Neuroscience investigations are carried out in various research sections:**

- Biobehavioural Pharmacology
- Biobehavioural Pharmacology
- Laboratory of Cellular & Molecular Pathophysiology
- Biopsychology
- Clinical Neuroscience
- Human Neurochemical Pathology
- Molecular Pharmacology
- Molecular Neuroscience
- Neuroimaging
- Pharmacogenetics
- Psychiatric Neurogenetics
- Smoking and Nicotine Dependence Research Unit
- Ontario Tobacco Research Unit
- Transgenic Centre
- Positron Emission Tomography Centre.

**The Clinical Research Department directs clinical research with specific emphasis on five designated sections:**

- Mood & Anxiety
- Schizophrenia
- Addictions
- Personality & Psychopathology
- Psychobiology of Aggression & Antisocial Behaviour

The Social, Prevention & Health Policy Research Department conducts innovative research, using state-of-the-art methodological and statistical techniques in areas that are relevant and topical in the community and through international projects.

**The Department contains the following 6 sections:**

- Culture, Community & Health Studies
- Health Systems Research & Consulting
- Population & Life Course Studies
- Public Health & Regulatory Policy
- Social Factors and Prevention Interventions
- Women's Mental Health & Addiction

## **Support Offered for Clinical Trial Services:**

CAMH offers a strong commitment to research. We have on our staff, dedicated scientists and researchers, and excellent collaboration with various funding agencies. CAMH is also equipped with state-of-the-art, in house research facilities including the Positron Emission Tomography (PET) Centre which allows researchers to scan the brains of live human subjects.

## **Positron Emission Tomography Centre, CAMH**

Positron Emission Tomography (PET) is a medical imaging technique uniquely suited to study chemical and metabolic disturbances in patients and assess the effects of treatment. PET uses radioactive probes that are selected to target specific aspects of the brain chemistry: for example, the dopamine system in schizophrenia or the serotonin system in depression. After injection of a minute amount of these radioactive probes in a patient, the PET camera can measure their distribution in the brain. By performing PET scans before and after treatment with a medication,

PET can measure the effects of that medication on the brain. The researchers at the Centre for Addiction and Mental Health (CAMH) have been using this technique over the last ten years to optimize the use of current medications to treat mental disorders and to find new ways of developing better drugs.

A typical example of this type of research has been the study of medications used in the treatment of schizophrenia. It was found that, very often, too much medication was being prescribed leading to undesirable serious side effects. As a result, patients often refused to take their medication because of these side effects. These PET studies were able demonstrate that successful response to the drug therapy could be obtained with much lower doses of the medication thereby avoiding those serious side effects. Another example of the work being carried out at the CAMH's PET Centre is related to antidepressants used to treat depression. There is a type of antidepressants known as selective serotonin reuptake inhibitors (SSRIs) [Prozac® probably being the most widely known SSRI by the general public]. These antidepressants work by blocking ("inhibiting") the reuptake of serotonin by the brain cells.

Despite the fact that SSRIs produced by several different drug companies have been used in millions of patients around the world, nothing was known about the degree of serotonin reuptake inhibition in the brain of patients being treated. Scientists at CAMH set out to develop a new PET probe that could measure the serotonin reuptake inhibition by the SSRIs. Using their new probe, they were able to measure the degree of inhibition caused by several SSRIs.

This work also provides new approaches for the discovery and evaluation of new drugs. This new probe is now being adopted worldwide as a new research tool by other PET research groups.

More recently, the CAMH PET Centre has started a new project to develop a new radiotracer to image amyloid plaques in Alzheimer's Disease. Additional uses for this technology included tracking metabolic activity in the brain which can demonstrate whether a tumour is malignant or benign or to measure the size and reduction or growth of a tumour. These examples illustrate some aspects of work being carried out at the CAMH PET Centre, work that bridges basic laboratory research to the bedside, fulfilling the centre's goal of improving the life of individuals suffering from mental illness.

This type of research does present many technical challenges. One of those challenges is to have a PET scanner with sufficient resolutions (to see small brain structures) and sufficient sensitivity to detect the minute amounts of the radioactive probes present in the patient's brain. Sensitivity is a performance index of a PET camera that indicates how well it can detect and measure very faint signal. The centre's PET Centre has acquired a new brain PET camera that is currently the most advanced and sophisticated unit anywhere in the world. The HRRT/DART (Depth-encoded Advanced Research Tomograph) is the "Hubble telescope" of brain PET imaging.

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## University of Toronto



The University of Toronto is the largest university in Canada, and one of the largest in North America. It has over 67,000 students, more than 11,000 faculty and staff, and 387,000 alumni. U of T's annual operating budget is over C\$1.1 billion and investigators attract research grant and contract support of C\$517 million per year. Include research funding from our affiliated teaching hospitals and annual investments in research amount to more than C\$ 1 billion, annually. There are three major U of T campuses that cover approximately 3 km<sup>2</sup> of land. The university offers 75 PhD programs and has 14 professional faculties. There are nine fully affiliated teaching hospitals associated with the University of Toronto. The U of T library has more than 15 million volumes and is consistently ranked as one of the top research libraries in North America. Innovation has long been a hallmark at U of T. During its 175-year history, the university has been home to some of the world's most original thinkers. Its graduates include six Nobel Prize winners, 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. As well, 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. As the nation's top research university, U of T aims to push the frontiers of knowledge on all fronts.

### **Core Technologies Include**

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

### **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 (IBBE)**

U of T's Institute of Biomaterials and Biomedical Engineering (IBBE) 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 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, bio-molecular 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.

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## Faculty of Nursing



The 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. The faculty is renowned nationally and internationally for its educational programs and the quality of research carried out by its faculty members. University of Toronto is one of the top research-intensive universities in North America, offering a distinctive environment for the pursuit and development of knowledge. Parallel to the university's mission, the 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 healthcare system. The Faculty of Nursing continues to attract research funding from various sponsors including the federal and provincial government. In 2004-05, a total of \$5.5 million of research funding was received for various research projects and programs undertaken by faculty researchers. The diversified interests in the research areas at the Faculty of Nursing have resulted in the development of the following research themes and clusters. Faculty researchers are associated with these clusters that further foster and develop their respective research interests with the necessary space and facilities provided by the new location of the Faculty of Nursing at 155 College St.

### **Nursing Health Services Research**

Nursing health services research involves the application of research methods from social and health sciences, biostatistics and economics to investigate questions relating to nursing and health services resource planning, organization, management, financing and delivery. Research focuses include health human resources, nursing effectiveness, nursing and health outcomes, nurse costing, quality work environments, health care teams, nursing leadership and patient safety issues, with a particular emphasis on reformation of organizational culture, building technological tools for safe care, delivering processes of safe care and applying human factors system designs in health care.

### **Diversities & Politics of Health**

This research cluster unites scholars who re-examine conventional ways of conceptualizing nursing, health care and health promotion. By analysing social relations and discourses in these fields, this group of academics explores their assumptive foundations and proposes alternative, hybrid and interdisciplinary ways of thinking and researching. The group recognizes and is informed by political, theoretical and methodological diversities. Particular focuses of research include social inequities in health, illness and nursing, gender as a determinant of health, participatory and action approaches to research, migration and health, aboriginal Canadians' health, HIV/AIDS, redefinitions of traditional boundaries between politics and ethics and theoretical approaches exploring nursing complexities in the 21st century.

### **Nursing Interventions**

The focus of this research cluster is on rigorous evaluations of conventional and innovative forms of nursing care, using randomized controlled trials, theory-driven evaluations and systematic reviews of the evidence. Studies are conducted in formal and informal healthcare settings, addressing a wide variety of health and illness issues, e.g., maternal-newborn health, cancer, cardiovascular disease and acute and chronic pain in adults and children. Many of the studies are multidisciplinary and international in scope.

## **The Clinical Simulation Learning Centre (SIMS Lab)**

In its renovated space the 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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## Leslie Dan Faculty of Pharmacy



### **Drugs – Discovery, Development, Delivery and Utilization: Optimizing Drug Therapy for a Multicultural Diverse Society**

The Leslie Dan Faculty of Pharmacy is committed to improving the health of Canadians through education and research. It is a national leader in the education of pharmacy professionals and in pharmacy practice, social and administrative pharmacy and pharmaceutical sciences research. The faculty is focused on nurturing a culture of innovation and boosting the entrepreneurial spirit of its researchers who endeavour to move drug discovery to commercial viability.

In early 2006, the faculty will move to the Leslie L. Dan Pharmacy Building at the corner of Queen's Park and College Street – in the midst of the Toronto academic health sciences community. With the largest student complement of any pharmacy school in Canada and greater than most U.S. schools, the faculty provides unparalleled pharmacy programs for more than 1,000 undergraduate, post-baccalaureate doctor of pharmacy (PharmD) and internationally trained pharmacy students. The undergraduate program in pharmaceutical chemistry is an ideal training ground for students interested in pursuing a career in the pharmaceutical industry. In addition there are almost 130 graduate students pursuing master's and PhD degrees. Continuous professional development and customized executive programs are offered for practising pharmacists, pharmaceutical industry professionals and academics. Programs on drug information are presented for members of the general public.

### **For information on developing a customized program for your company contact:**

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The Leslie L. Dan Pharmacy Building is designed by the internationally renowned British firm of Foster and Partners. The building campaign has galvanized the pharmacy sector – as evidenced by the more than \$65 million in government, university and private sector support. The building project has been supported enthusiastically by the pharmacists of Ontario through the Ontario Pharmacists' Association Lecture Hall Campaign. To date more than 150 pharmacists – both U of T alumni and others – have committed \$7,500 each to the campaign by naming desks in the largest lecture hall. Many corporations and hundreds of other individuals who make their living through pharmacy have supported the building project at other giving levels. As the building nears completion the excitement is spreading to the architecture and construction communities and the general public. Feature articles describing the building have appeared in Building Magazine, Canadian Architect, Azure, the U.S. publication Architectural Record, the British publication Wallpaper as well as the Toronto Star and the Globe and Mail.



### **Drug Discovery: From the bench to bedside**

Research conducted by faculty principal investigators encompasses all aspects of the discovery, development, administration and utilization of therapeutic drugs. A pharmacy-led drug design/medicinal chemistry platform is being developed and is intended to be a catalyst for interdisciplinary research and collaboration, both pharmacy-initiated and partner-initiated. The research clusters of the faculty are organized among the following three divisions:

**Pharmaceutical Sciences** – The main clusters within this division are pharmaceutics and drug delivery, pharmacokinetics, pharmacology and toxicology. Research endeavours within the division range from fundamental drug discovery at the molecular level to clinical trials. The research activities can impact therapeutic uses including treatments for cancer, HIV/AIDS, neural injuries and diseases, substance abuse, autoimmune diseases, heart diseases and birth defects.

**Pharmaceutics:** In the area of pharmaceutics there is research focused on the rational design and development of polymer-based drug delivery systems, enhanced and modulated drug delivery, the discovery and development of novel radiopharmaceuticals for diagnostic imaging or targeted radiotherapy of cancer and the development of new targeted and controlled release drug delivery systems that take into account the short biological half-life and strong systemic side effects associated with many drugs, including old drugs and the new generation of drugs such as proteins, peptide and immunomodulators. Researchers within this group hold a number of patents including one for molecular dispersion composition with enhanced bioavailability.

**Pharmacokinetics:** Faculty members within this cluster are focused on understanding what happens to a drug once it is introduced to the body. Among other topics, research is aimed towards an understanding of the handling of drugs and their metabolites within eliminating organs, the molecular regulation of drug transport proteins and drug transport processes across cell membranes.

**Pharmacology and Toxicology:** Research projects among this group range from the study of idiosyncratic drug reactions to forensic toxicology studies related to substance abuse. Unexpected adverse reactions occur in a small percentage of patients that take a drug and represent a serious medical problem. Since such reactions often lead to withdrawal or severe restrictions on the use of a drug, which in turn significantly adds to the uncertainty of drug development, knowledge gained in these studies facilitates the identification of toxicologically predisposed humans, the development of strategies to minimize unwarranted drug toxicity and an understanding of disease mechanisms, risk factors and novel treatments.

**Social & Administrative Pharmacy:** Activities in this division range from pharmacoeconomic studies to developing lifelong educational models for healthcare -- in particular pharmacy -- professionals through to patients' use of complementary/alternative medicine. Research findings impact health and clinical policy, medicine regulations and reimbursement and professional education.

**Pharmacy Practice:** This is an emerging specialty area for the faculty. It is intended that this newly created division will unite educators and researchers who have an emphasis in the area of clinical pharmacy

that is focused on patient-oriented drug therapy. The faculty is currently drawing together members who are engaged in pharmacy education and research who for the most part also maintain clinical practices to ensure continued awareness of clinical problems and clinical relevance. Many of these researchers are being drawn from our affiliated teaching hospitals.

**Faculty members hold a number chairs and professorships co-funded by the government, professional and industry partners, the university and the faculty. They include:**

Canada Research Chair in Immunotoxicology – Dr. Jack Uetrecht  
GlaxoSmithKline Chair in Pharmaceutics and Drug Delivery – Prof. Ping Lee  
Murray B. Koffler Chair in Pharmacy Management – Prof. Joe D’Cruz  
F. Norman Hughes Chair in Pharmacoeconomics – Dr. Murray Krahn  
Ontario College of Pharmacists Professorship in Pharmacy Practice – Prof. Zubin Austin

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## The Donnelly CCBR



The Terrence Donnelly Centre for Cellular and Biomolecular Research (Donnelly CCBR) creates a unique organization at the University of Toronto where investigators from the Faculty of Medicine, the Leslie Dan Faculty of Pharmacy, the Faculty of Applied Science and Engineering and the Faculty of Arts & Science are brought together. Donnelly CCBR is an open, fluid environment that encourages new ways of approaching biological problems by stimulating unconventional interactions among disciplines.

The essence of the Donnelly CCBR lies in three programs that span the leading areas of biomedical research: bioengineering and functional imaging; integrative biology; and models of disease. The Donnelly CCBR premise is that each program - and the entire centre - will thrive best if it includes biological, physical, computer and engineering scientists working together in a communal setting at the University of Toronto to shape and define the „New Biology.“

When fully realized, the Donnelly CCBR will include more than 35 principal investigators and their teams. More than 20 investigators with existing labs at the University are moving into the Donnelly CCBR, and recruitment of new scientists is ongoing. By creating an ideal interdisciplinary research environment in physically stunning space, the Donnelly CCBR will encourage outstanding minds to come to and stay in Canada. In fact, several new faculty members have already been recruited to the Donnelly CCBR from universities in the United States and in Europe – this cadre of new investigators includes scientists who represent the first joint recruits involving the departments of computer science and chemistry and faculties of pharmacy and medicine.

The Donnelly CCBR aims to create an environment that will allow immediate transfer of discoveries in one system to another – in this way, interesting questions can be quickly identified and the results applied to important biomedical problems. Here are some of the key research projects currently underway at the Donnelly CCBR:



A team of geneticists, led by Donnelly CCBR Director Brenda Andrews and fellow professors Charlie Boone and Timothy Hughes, are establishing a state-of-the-art functional genomics laboratory on the top floor of the centre. The lab aims to use the astounding techniques of post-genome biology to systematically explore the function of all genes in the cell. CCBR scientists, led by Professors Andrew Emili and Jack Greenblatt, are also exploring the far more complex set of all the proteins that those genes can generate – the ‘proteome’. Understanding and cataloguing the proteome is a massive computing task, requiring cutting-edge information technology and mass spectrometry

equipment. The overall goal is to produce the first glimpse of the complex wiring diagram for the cell and to use this diagram as a template for predicting how to manipulate the cell’s circuitry with small molecules or drugs.

In another part of the building, Donnelly CCBR colleagues Professors Peter Zandstra and Cindi Morshead are engaged in exploring what may well be the most fascinating cells in the human body: stem cells. Zandstra's team is using engineering-based approaches such as modelling, molecular engineering and bioreactor design, to enable new stem cell based therapies. Morshead is investigating whether it is possible to activate the stem cells in a stroke victim's brain to help self-repair the resulting neural damage. Interactions between the stem cell and genetics teams are likely to produce completely unanticipated new approaches to understanding how stem cells work.

In complementary projects, Professors Molly Shoichet and Michael Sefton are using techniques of tissue engineering to discover new ways to encourage nerve cells to repair and grow. Materials science approaches are geared towards discovering new coatings for transplanted material to prevent immune rejection in patients. The CCBR aims to create an environment that will allow immediate 'transfer' of discoveries in one system to another – in this way, interesting questions can be quickly identified and the results applied to important biomedical problems. One can only imagine how interactions between tissue engineers, cell biologists, geneticists and others will encourage new approaches to gene therapy, among other advances.

The Donnelly CCBR has also devoted an entire floor – more than 20,000 square feet – to the growing field of 'bioinformatics' and computational biology: the nexus of information science and biology. The large-scale biology projects in the centre, some of which are outlined above, create massive amounts of data that is essentially meaningless unless it is analysed using innovative computer algorithms that help scientists discern important patterns in the data. These patterns reveal new and important information about cell and organism function.

In addition to housing cutting-edge research, the Donnelly CCBR will be a collaborative classroom, providing hands-on training for hundreds for undergraduate and graduate students and postdoctoral fellows.

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