BIENNIAL REPORT 2013-2015

THE MCLAUGHLIN CENTRE

"One grade only, and that the best"

ROBERT SAMUEL MCLAUGHLIN (1871-1972)

UNIVERSITY OF TORONTO

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EXECUTIVE'S MESSAGE

DIRECTOR'S MESSAGE

The University of Toronto McLaughlin Centre's sphere of impact continues to grow. As highlighted in this report, we've funded DNA research that miraculously allows children to overcome a disabling movement disorder and walk for the first time. We've funded genomic research to map factors underlying brain cancer, enabling rational treatment options. We've funded futuristic genome sequencing to facilitate earlier and more accurate diagnosis of autism. We've also supported research on ethics, policy and education for the Canadian Personal Genome Project — a McLaughlin Centre-led initiative to illuminate the path for 21st century medical practice. Our funding formula will continue to support excellence in genomics research and education close to the patient, in partnership with anyone who shares our vision. I welcome you to join us.

Stephen Scherer PhD DSc FRSC,
Director

CHAIR OF OVERSIGHT COMMITTEE'S MESSAGE

In 40 years as a clinician-scientist at the University of Toronto, I have had a terrific opportunity to witness first-hand the impact of McLaughlin philanthropy. It began with travelling fellowships, and continues through the Centre's concentration on genomics research and genomic medicine, with ongoing contribution to medical education through the MD/PhD program, directed so ably by Dr. Norman Rosenblum. I have been thrilled to witness the Centre's magical transformation under Director Steve Scherer. The university hospitals participate in its matching concept, and the focus on early-stage projects supports those that might otherwise never get started. Major gains by McLaughlin-funded scientists are advancing our ability to diagnose and treat numerous conditions with a genomic basis, including autism, certain forms of epilepsy and specific brain tumours. The University can take great pride in the work of the Centre's director and staff, and other scientists who have distinguished themselves locally and internationally through McLaughlin funds.

Charles Tator CM MD PhD FRCSC FACS,
Chair Oversight Committee

10 BIG STORIES

Accelerator and Education Grants for 2013-2015 in Genomic Medicine

ONE Recipient of the 2014 Maurice McGregor Award for rising stars in the field of health technology assessment, Yvonne Bombard (PhD) is concerned with the ethical and financial impact of whole-genome sequencing. Her research at the University of Toronto and St. Michael's Hospital bridges the gap between the fundamental questions of health ethics and governmental policy. A stand-out in her field, she aims to discover and research the effects of genetic sequencing on the health care system and what this means for individual Canadians. As a native of Toronto, she returned to Canadian health care from the United States where she split her time between Memorial Sloan-Kettering Cancer Center and Yale University. Dr. Bombard stands poised at what promises to be a transformative career and to be herself an indispensable aid to modern genetic medicine and policy.

TWO Trained as a molecular geneticist, Michael Szego (PhD, MHSc)'s work spans the scope of human experience, from the cellular level to grand ideas of life and death. With his masters in ethics, he works to bridge the gap between research and human interaction. With the increasing accessibility of whole genome testing, ethicists like Dr. Szego are empirically examining the benefits and risks from the perspective of participants to help inform the consent process. The study of ethics reaches into all facets of medicine, and goes hand in hand with clinical practice. As an investigator in the Canadian Personal Genome Project, Dr. Szego is leading the way for interdisciplinary research, bridging the gap between the physical and the moral.

THREE Brendan Frey (PhD) doesn't believe in junk DNA. Space recently thought to be inhabited by standard and unvarying genetic code is proving valuable in the deciphering of genetic disorders, and Dr. Frey and his research team are world leaders in the genetic recipes that orchestrate how genes are used in normal and diseased tissues. Highly trained in both engineering and machine-learning computational biology under the guidance of Geoffrey Hinton, Dr. Frey studies neural networks in order to make sense of larger genomic datasets. His research at the University of Toronto has led to deeper understanding of a variety of diseases, including spinal muscular atrophy, nonpolyposis colorectal cancer and autism spectrum disorder.

FOUR Elise Héon (MD), the former Chief of Ophthalmology and the Associate Surgeon-in-Chief for Research at The Hospital for Sick Children, has been working to develop the field of eye genetics for 20 years. Dr. Héon may be known for having been airlifted to safety (April 2013) after spending 36 hours on an isolated cliff face in Arizona. However, Dr. Héon's contributions to Canada's medical community vastly outshine her accidental stardom. As a senior scientist at SickKids, she is at the forefront of genetic ophthalmology. Using genome sequencing to identify the disease-causing genes, Dr. Héon and her team are improving outcomes for patients and in some case enabling the return of sight to children once destined for blindness.

FIVE Igor Jurisica (PhD) sees computational technology as an essential connection between patient care and research. By creating algorithms and maps of related proteins, genes and microRNAs, Dr. Jurisica is making context-specific connections in the liminal space between known and unknown data. A Slovakian father of two, his work at the University of Toronto and the Princess Margaret Cancer Centre has propelled him into a coveted position on Thomson Reuters' list of Highly Cited Researchers 2014. His research is creating a comprehensive blueprint of cancer-altered versus healthy human signaling cascades, diagnoses and interventions will be more precise and effective, and resources needed to run experiments and deliver treatments will be more effectively used.

SIX

As an identical twin, Jordan Lerner-Ellis (PhD) was always interested in the relationship between genes and human traits. Entering university as a professional jazz guitarist, his aspirations quickly shifted towards the sciences as he pursued a career in molecular genetics. Since his return to Ontario in 2011 from a clinical fellowship at Brigham and Women's Hospital and Harvard Medical School, he has taken on the role as head of Advanced Molecular Diagnostics at Mount Sinai Hospital. His work is devoted to improving the quality and utility of genetic testing by using new technologies to create efficiencies in the public healthcare system. His research also aims to find the cause of disorders in families that may have gone previously undiagnosed, with a primary interest in hereditary conditions related to breast, ovarian and colon cancers.

SEVEN

When Berge Minassian (MD) was three, he and his family gathered around a small black and white television in pre-civil-war Lebanon and witnessed man's first steps on the moon. With the dream of following in their scientific footsteps, Dr. Minassian came to Canada and The Hospital for Sick Children and the University of Toronto in the hopes of advancing personalized medicine for children with neurological disorders. In 2013, with the aid of McLaughlin Centre funding, Dr. Minassian used genomic technologies to diagnose and, for the first time, treat children with infantile onset movement disorder, allowing them, for the first time, to take steps towards their own dreams.

EIGHT

Psychiatry runs in Greg Costain (PhD)'s family, much as schizophrenia runs in some families of those he studies in Dr. Anne Bassett's Clinical Genetics Research Program at the Centre for Addiction and Mental Health. With a long line of medical doctors in his family, Dr. Costain was taught at an early age to be inquisitive about the world around him. After pursuing graduate studies in mathematics, he followed his parents' path and enrolled in the University of Toronto's MD/PhD program. Through McLaughlin Centre funding, Dr. Costain is applying genome-scanning experiments to identify genes involved in schizophrenia and other neuropsychiatric conditions. Equally important, he is working to develop practice guidelines of how to use the new genetic data to benefit family health care.

NINE

Clinicians across the country have new tools at their disposal, thanks to Michael Brudno (PhD) at the University of Toronto and The Hospital for Sick Children. Russian born and American trained, Dr. Brudno came to the University of Toronto in 2006 as an assistant professor in the department of computer science. By developing websites such as PhenoTips (www.phenotips.org), his work gives patients and their medical doctors comprehensive, up-to-date and collaborative answers to previously mysterious genetic conditions. Dr. Brudno's aim is to continue to integrate original databases such as PhenoTips and PhenomeCentral into electronic health records in order to expedite therapeutic processes for millions of Canadians.

TEN Even at a young age, Raymond Kim (MD, PhD)'s achievements were those of a seasoned physician, including his doctoral work from the University of Toronto's MD/PHD program, supervised by renowned researcher Dr. Tak Mak. As impressive as his resumé is, Dr. Kim's greatest sense of accomplishment comes from the money donated on his behalf by the families of his patients. These patients, whose families give so generously, are children with the rare disorder Primary Ciliary Dyskinesia (PCD). Geneticists such as Dr. Kim hope to validate PCD's genetic link. Currently little to no conclusive testing is done for many genetic disorders, and it is Dr. Kim's hope that by continuing to sequence and research pediatric patients, the future generation of geneticists can provide better treatment options to adult and child patients alike.

EDUCATION HIGHLIGHTS

EDUCATION PROGRAM DIRECTOR'S MESSAGE

Genomic medicine is experiencing a revolutionary period, reflected by discoveries enhancing the basic understanding of genomic organization, gene expression, epigenetics and genome variation. The dividends for human health are potentially staggering. The physician scientist occupies a critical niche where genomics research intersects with medical science and practice. To move medicine forward, our trainees will need to understand the challenges most relevant to patients and, more broadly, to the healthcare system. They will need to integrate this new-found knowledge of genomics with their own research questions, informed by the patients they see, so this is where the McLaughlin Centre is making strategic investments.

Norman Rosenblum MD FRCPC,
Education Program Director

UNIVERSITY OF TORONTO MD/PHD PROGRAM (2013-15)

Josh Abraham
Susan Armstrong
Brian Ballios
Mike Bohdanowicz
Matthew Carr
Caitlin Chrystoja
Greg Costain
Ashish Deshwar
Ayan Dey
Dilan Dissanayake
Laura Donaldson
Kyle Eastwood
Robyn Elphinstone
Laura Erdman
Carlyn Figueiredo
Jonathan Fuller
Nicholas Howell
Janine Hutson
Amanda Khan
Jieun Kim
Grace Lam
Natasha Lane
Alvin Lin
Gord McSheffrey
Patrick McVeigh
Ilya Mukovozov
Sean Nestor
Enoch Ng
Ben Ouyang
Andrew Perrin
Jennie Pouget
Maneesha Rajora
Lianne Rotin
Jacob Rullo
Nardin Samuel
Graeme Schwindt
Shrey Sindhwani
Marko Skrtic
Jonathan So
John Soleas
Patrick Steadman
David Tsui
Rob Vanner
Linda Vi
Teja Voruganti
Hoyee Wan
Xin (Kevin) Wang
Jared Wilcox
Curtis Woodford
Florence Wu
Richard Wu
Kirill Zaslavsky

COMPREHENSIVE RESEARCH EXPERIENCE FOR MEDICAL STUDENTS (CREMS) SCHOLAR PROGRAM

2013

Melanie Audette
Kevin Kirouac
Antonia Kreso
Judy Qiang

2014

Aneet Mann
Xin Zhang

RESEARCH HIGHLIGHTS

GRANTS FUNDED FOR 2014

Anne Bassett MD, Centre for Addiction and Mental Health, Schizophrenia Genomics
Benjamin Blencowe PhD, University of Toronto, RNA Splicing
Yvonne Bombard PhD, St. Michael's Hospital, Health Genomics and Policy
Ronald Cohn MD, The Hospital for Sick Children, Clinical Genomics
James Dowling MD PhD, The Hospital for Sick Children, Hyperthermia Genes
James Ellis PhD, The Hospital for Sick Children, Induced Pluripotent Stem Cells
Brendan Frey PhD, University of Toronto, Computational Genomics
Elise Heon MD, The Hospital for Sick Children, Genetics of Eye Disease
Prabhat Jha MD DPhil, St. Michael's Hospital, Global Health Genomics
Igor Jurisica PhD, Princess Margaret Cancer Centre, Health Informatics
Jordan Lerner-Ellis PhD, Mount Sinai Hospital, Genome Diagnostics
Christoph Licht MD, The Hospital for Sick Children, Kidney Disease
Geoffrey Liu MD, Princess Margaret Cancer Centre, Pharmacogenomic Epidemiology
David Maslove MD, St. Michael's Hospital, Critical Care Informatics
Stephen Meyn MD PhD, The Hospital for Sick Children, Prenatal Genomics
Berge Minassian MD, The Hospital for Sick Children, Neurogenomics, Epilepsy
York Pei MD, Toronto General Hospital, Liver Genetics
John Strauss MD, Centre for Addiction and Mental Health, Psychiatric Genetics
Uri Tabori MD, The Hospital for Sick Children, Pediatric Cancer Predisposition

FIVE SIGNIFICANT MCLAUGHLIN CENTRE PUBLICATIONS

Rilstone JJ, Alkhater RA and Minassian BA. Brain dopamine-serotonin vesicular transport disease and its treatment. N Engl J Med. Feb 2013

Jiang YH, Yuen RK et al. Detection of clinically relevant genetic variants in autism spectrum disorder by whole-genome sequencing. Am J Hum Genet. Aug 2013

Mack SC et al. Epigenomic alterations define lethal CIMP-positive ependymomas of infancy. Nature. Feb 2014

Szego MJ et al. Predictive genomic testing of children for adult onset disorders: a Canadian perspective. Am J Bioeth. Mar 2014

Beaulieu CL et al. FORGE Canada Consortium: outcomes of a 2-year national rare-disease gene-discovery project. Am J Hum Genet. Jun 2014

EXECUTIVE COMMITTEE

Alison Buchan PhD FCAHS (Chair), Vice Dean, Research and International Relations, University of Toronto
Stephen Scherer PhD DSc FRSC, Director, McLaughlin Centre, University of Toronto
Peter Singer OC MD MPH FRSC, Director, Sandra Rotman Centre, University Health Network
Arthur Slutsky MD, Vice-President, Research, St. Michael's Hospital
Peter St George-Hyslop MD FRS FRSC FRCPC, Director, Tanz Centre for Research in Neurodegenerative Diseases
Catharine Whiteside MD PhD, Dean, Faculty of Medicine, University of Toronto
Jim Woodgett PhD, Director of Research, Lunenfeld-Tanenbaum Research Institute

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Virginia McLaughlin, President, Helmhorst Investments Limited
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Charles Tator CM MD PhD FRCSC FACS (Chair), Professor of Neurosurgery, Toronto Western Hospital
J. Christopher C. Wansbrough, Chairman, Rogers Telecommunications Limited
Catherine Whiteside MD PhD, Dean, Faculty of Medicine, University of Toronto

FINANCIAL HIGHLIGHTS

The McLaughlin Centre was founded in 2001 by a $50M bequest from the R. Samuel McLaughlin Foundation. In 2006-07, $1M of the principle was matched by the Ontario Government to establish the Graduate Student Endowment Fund (GSEF)-McLaughlin Fellowships. The book value of Endowment ($51,009,694) comprises the McLaughlin Endowment ($49,009,694) and GSEF-McLaughlin Fellowships ($2,000,000). The book value for 2013-14 is identical to 2012-13.

SUMMARY OF THE MCLAUGHLIN ENDOWMENT

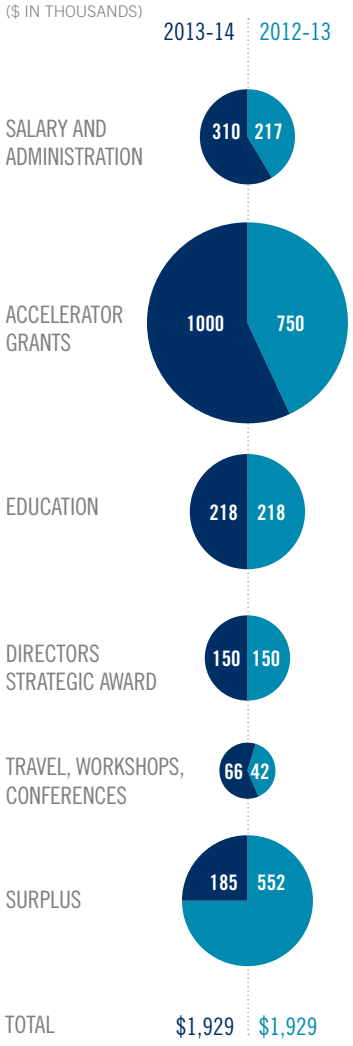
(FOR THE YEAR ENDED APRIL 30 2014)

		2013-14	2012-13
MARKET VALUE OF ENDOWMENT	McLaughlin Endowment	52,171,987	47,371,187
	GSEF-McLaughlin Fellowships	1,763,926	1,601,611
		53,935,913	48,972,799
ANNUAL PAYOUT	Annual Payout (% Book Value)	4.21%	4.21%
	McLaughlin Endowment	2,075,131	2,075,131
	GSEF-McLaughlin Fellowships	70,160	70,160
		2,145,291	2,145,291
	GSEF-McLaughlin Fellowships	(70,160)	(70,160)
	Financing payback on McLaughlin Endowment*	(146,262)	(146,262)
ENDOWMENT PAYOUT FOR DISBURSEMENT		1,928,869	1,928,869

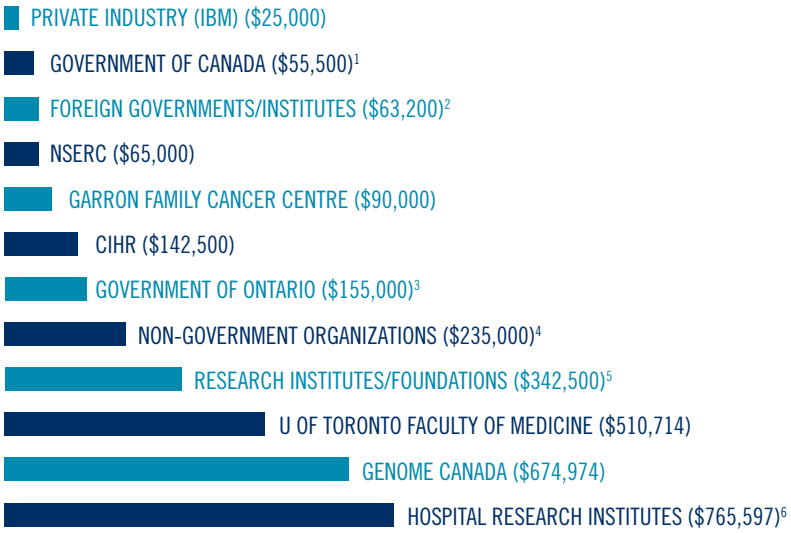
* Funds available for Disbursement are the McLaughlin Endowment payout less annual reductions to repay financing

MCLAUGHLIN CENTRE DISBURSEMENTS

($ IN THOUSANDS)



PARTNER INVESTMENTS TO MCLAUGHLIN CENTRE FUNDS 2012-14 (TOTAL $3,125,000)



1. Government of Canada: Canada Research Chairs Program, Networks of Centres of Excellence 2. Foreign Governments/Institutes: British Consulate, US Dept. of Defense, Texas Biomedical Research Institute, American Society of Human Genetics, Samsung Medical Institute (Korea), Israel Cancer Research Fund, Human Genome Variation Meeting (Shanghai), GA4GH 3. Government of Ontario: Ontario Research Fund, Ministry of Economic Development & Innovation, Public Health Ontario, ON Mental Health Foundation 4. Non-Government Organizations: Canadian Cancer Society Research Institute, Institute of Kidney Life Science Technology, Foundation Fighting Blindness,Canadian Gene Cure Foundation, John and Lotte Hechte Memorial Foundation, Alzheimer Society of Canada,Ontario Shores Foundation for Mental Health 5. Research Institutes/Foundations: Ontario Genomics Institute, Ontario Brain Institute, Gairdner Foundation, Personal Genome Project Canada,Terry Fox Research Institute, PMH Foundation, Pediatric Brain Tumor Foundation, Lee K. & Margaret Lau Family Foundation, Mira Godard Research Fund 6. Hospital Research Institutes: Women's College Research Institute, Mt. Sinai Hospital, SickKids Research Institute, Centre for Genetic Medicine-SickKids, The Centre for Applied Genomics

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