INNO'VA-TION and *INNO'V@-TION*^{2}

Essays by Leading Canadian Researchers

"Among the many valuable partners who contribute to the success of the CFI's programs and goals are Canada's granting councils and the individual researchers they fund. Too often we fail to recognize those who have demonstrated a commitment to advancing innovation in Canada. We should reserve our greatest appreciation and admiration for our nation's researchers."

–Dr. David W. Strangway,
President and CEO, Canada Foundation for Innovation (CFI)
On why he commissioned a collection of essays on Innovation

Two years ago, the CFI's President & CEO issued a challenge. That challenge was to assemble a collection of essays that would illustrate the world-class, cutting-edge research taking place in Canadian institutions and the brilliant minds leading the way.

Today, thanks to the collaborative efforts of the editors, Lois Claxton and James Downey, and the researchers identified with the assistance of the federal granting councils, the CFI is pleased to present a collection of works by thirty-three unique individuals whose research has impacted the quality of life of Canadians and continues to shape our future.

The essays

INNO'VA-TION: Essays by Leading Canadian Researchers, a volume featuring 25 personal essays, is being published in English and French by Key Porter in collaboration with the Canada Foundation for Innovation (CFI). And, ***INNO'V@-TION***^{2}, a CD and Web site featuring eight more personal essays, also in French and English, will be on the World Wide Web—www.innovation.ca.

The range of these Canadian pioneers on the front lines of science and intellectual endeavour is extraordinary—from aquaculture and healthcare, to quantum physics and climate change. Indeed, the very diversity of the essay topics mirrors today's multidisciplinary approach research. As editor James Downey puts it: "…contemporary research is more than ever a collaborative enterprise. Little of value is accomplished in any field of research today that doesn't involve the convergence of expertise from a number of cognate disciplines."

We hope you will enjoy discovering some of the many faces behind the world of innovation.

About David Strangway:

David Strangway has been president and CEO of the Canada Foundation for Innovation (CFI) since 1998, and has overseen an investment of close to $2 billion in infrastructure at Canadian research institutions. Before joining CFI, Dr. Strangway was president of University of British Columbia for 12 years and, Acting President at the University of Toronto where he had previously received his PhD. He is an Officer of the Order of Canada and has been honoured with the NASA Medal for Exceptional Scientific Achievement—in 1970. He joined NASA as Chief of the Geophysics Branch, where he was responsible for the geophysical aspects of the Apollo missions. He is the author of more than 165 scientific papers and publications in the area of geophysics.

About the Editors

James Downey is a professor of English at the University of Waterloo and former president of that university. He was also president of the University of New Brunswick and Carleton University. He is a graduate of Memorial University and of the University of London. Mr. Downey has published widely on academic leadership, educational reform and English literature.

Lois Claxton is corporate secretary of the University of Waterloo. A graduate of that university and the University of Toronto, she worked as a professional librarian for the federal government and the University of Waterloo before becoming corporate secretary.

About the Researchers

Essay: *Synchrotron Radiation: The Most Versatile Spectroscopic Sources*

G. Michael Bancroft is a professor of Chemistry at the University of Western Ontario and the Acting Director of Research at the Canadian Light Source in Saskatoon. Dr. Bancroft's research activities have spanned the fields of chemistry, physics, geology, and tribology, and have involved numerous large companies such as Dofasco, AECL, Imperial Oil, Chevron, and INCO.

Essay: *The Challenges of Constructing Social Indicators*

Paul Bernard is a professor of sociology at the University of Montreal. His areas of research and teaching include labour markets and social inequality, epistemology, research design, and methods. Dr. Bernard's recent work has focused on economic and labour-market segmentation, contingent work, job quality, the living arrangements of young people, welfare and production regimes, and social indicators.

Essay: *Up Everest With A Scalpel*

Douglas Boyd performed the world's first totally closed-chest, computer-enhanced, robot-assisted, beating-heart coronary bypass operation in September 1999. Today, he continues his innovative work in London at the University of Western Ontario's National Centre of Advanced Surgery and Robotics—where he is both the center's director and associate professor of surgery.

Essay: *From Fishing to Farming: The Domestication of New Species for Aquaculture*

Joseph Brown is Associate Professor at the Ocean Sciences Centre of Memorial University of Newfoundland and chair of the M.Sc. (aquaculture) program at Memorial. His research program is composed of both fundamental and applied research.

Essay: *From E-mail to Virtual Reality: The Role of Technology in Supporting Learning*

Tom Calvert is a professor of Information Technology and Vice President, Research & External Affairs at Simon Fraser University. His teaching and research have been at the interfaces between engineering, computing science, and human performance.

Essay: *Shaping a Visual Language for Our Times*

Sean Caulfield is currently Associate Professor in printmaking and a Canada Research Chair at the University of Alberta. His work can be found in various public and private collections including: Loyola University Chicago; University of Dallas; Ernst and Young, Toronto; University of Alberta; The Canada Council Art Bank, Ottawa; and the Alberta Art Foundation, Edmonton.

Essay: *Moving Maps and Geographic Information Systems onto the Internet*

David Coleman is a professor and chairman of the Department of Geodesy and Geomatics Engineering at the University of New Brunswick. In addition to his teaching and research at the university, he is also President of the Canadian Institute of

Geomatics and a consultant to clients in Canada, the United Kingdom, and Latin America.

Essay: *From Femtoseconds to Attoseconds*

Paul Corkum is Head of the Steacie Institute for Molecular Sciences at the National Research Council of Canada. His most notable accomplishment has been to introduce a model that describes how atoms and molecules ionize. He has extended it to become the current standard used by the international femtosecond science community.

Essay*: Reconstructing/Deconstructing the Tree of Life*

W. Ford Doolittle is a professor of Evolution and Ecology Genetics at Dalhousie University. In 1986 he became a Fellow and Director of the Evolutionary Biology Program of the Canadian Institute for Advanced Research. In addition to work in experimental biology, he has made periodic contributions to the theory of gene and genome evolution.

Essay: *A New Method of Cleaning Groundwater*

Robert Gillham has been a professor of hydrogeology in the Earth Sciences Department at the University of Waterloo since 1974, with research interests in the area of contaminant transport and remediation in groundwater.

Essay: *Putting Supercomputers on Ice*

Wagdi (Fred) Habashi is a professor of mechanical engineering at McGill University. Habashi established McGill's Computational Fluid Dynamics Laboratory and serves as its Director. He is also project leader of the Consortium Laval-UQAM-McGill and Eastern Quebec on supercomputing.

Essay: *Managing Change by Changing Managing*

Francis Hartman is a professor in the Department of Biochemistry at the University of Calgary. His research has been in the management of technological change. Dr. Hartman's SMART Management™ approach is being adopted by companies and project management teaching programs in Canada, the United States, and Europe.

Essay: *Medical Imaging of Mice: Does Your Mouse Need a CAT Scan?*

Mark Henkelman is Vice-President Research, Medicine, Biophysics at Sunnybrook and Women's College Health Sciences Centre. He is also a professor in the Departments of medical biophysics and medical imaging at the University of Toronto. Dr. Henkelman's

research is focused on expanding the use of MRI technology further into the diagnosis and the management of therapy for cancer.

Essay: *Imaging the Troubled Mind*

Sylvain Houle As Director of the Vivian M. Rakoff PET Imaging Centre at the Centre for Addiction and Mental Health and the University of Toronto, Dr. Houle finds himself perfectly positioned to pursue his broad research interests, which range from PET imaging technology, to the development of PET radioligands and their application in brain disorders.

Essay: *Genomics: A Question of Scale*

Thomas J. Hudson is Director of the Montreal Genome Centre, and teaches in the departments of human genetics and medicine at McGill University. He also practices medicine at the McGill University Health Centre of the Montreal General Hospital (Division of Immunology and Allergy). Internationally renowned for his work in genomics, Dr. Hudson's interests in human genetics focus on the dissection of complex genetic diseases.

Essay: *Culture on the Move: Rethinking Literature and Its History*

Linda Hutcheon is a Professor of English and Comparative Literature at the University of Toronto. Her many books on literary subjects have established her as a major literary theorist in North America, and have helped to promote a greater understanding of modern fiction, parody, postmodern literature, irony, feminist theory, and ethnic minority writing in Canada.

Essay: *High Temperature Superconductivity*

Catherine Kallin is a professor of Physics and Astronomy at McMaster University. She has served on a number of international scientific boards, and has recently returned to McMaster University from Santa Barbara where she co-organized a five-month workshop on high temperature superconductivity.

Essay: *Biotechnology, Public Policy, and the Unknown*

Bartha Maria Knoppers is a professor at the Université de Montréal's law faculty, and a senior researcher (C.R.D.P.) and counsel to the firm of Borden Ladner Gervais. She is also the current Chair of the International Ethics Committee of the Human Genome Project (HUGO).

Essay: *Exploring the Universe in Space and Time*

Simon Lilly is the Director General of the Herzberg Institute of Astrophysics of the National Research Council of Canada. The institute is responsible for operating all of Canada's national observatories, both in Canada and overseas. He is currently working in the Physics department at ETH Hoenggerberg in Zurich, Switzerland.

Essay: *Life as a Stable Isotopist: Romancing the Stones and More*

Fred J. Longstaffe is Dean of the Department of Earth Sciences at the University of Western Ontario and Director of the Division of Earth, Ocean & Atmospheric Sciences, Academy of Science, at the Royal Society of Canada. His research and teaching centres around the stable isotope chemistry and mineralogy of natural systems.

Essay: *Native-Newcomer Historical Inquiry*

Jim Miller is a professor of history at the University of Saskatchewan, where he has taught since 1970. Although his teaching and research initially focused on English-French relations, he shifted his focus in the early 1980s to study and teach the history of relations between native peoples and newcomers to Canada.

Essay: *The Promise of Quantum Computing*

Michele Mosca is Assistant Professor at the Department of Combinatorics & Optimization at the University of Waterloo. Mosca has made major contributions to the theory and practice of quantum information processing. He is a founding member of the Perimeter Institute for Theoretical Physics.

Essay: *Convergence, Interactive Media, and Innovation*

Michael J. Murphy is the former Director of the Rogers Communications Centre at Ryerson University in Toronto. The Centre is active in research in new media and communications, with a focus on new forms of content generation, storage, and delivery. He is currently a professor in Ryerson's School of Radio & Television Arts, Faculty of Communication & Design, teaching digital audio and media production techniques and graduate courses in advanced communications technology.

Essay: *Excitable Tissues and Virtual Worlds: Art, Science, and Technology*

Catherine Richards is a visual artist, working with old and new technologies. She is currently Associate Professor at the Department of Visual Arts, University of Ottawa. She is one of the first recipients of a two year Artist-in-Residence for Research (AIRes) fellowship jointly established by the Canada Council for the Arts and the National

Research Council of Canada (NRC) for her research that will be pursued in collaboration with the Institute for Information Technology in Ottawa in 2003.

Essay: *Changing the World: The Subversive Appeal of Sustainability Research*

John Robinson is currently director of the Sustainable Development Research Institute at the University of British Columbia and a professor in the university's Department of Geography. He teaches environmental studies courses at UBC, but spends most of his time creating research projects on a wide range of sustainable development issues.

Essay: *Canada's Families: Why History Matters*

Eric W. Sager A maritime historian and an author of numerous books on the shipping industry in Atlantic Canada, Dr. Sager is a professor of history and chair of the Department of History at the University of Victoria. He teaches courses on Canadian history, labour history, family history, and the use of computers in history.

Essay: *Engineering: Applied Ingenuity*

Martha Salcudean was appointed head of the Department of Mechanical Engineering at the University of British Columbia in 1985. Today, she is Associate Vice-President, Research at the university. Between 1985 and 1993, she led a large research team, establishing a world-class centre of process modeling in the pulp and paper area. She also holds the Weyerhaeuser Chair in Computational Fluid Dynamics.

Essay: *The Combined Effects of Climate Warming and Other Human Activities on Canadian Freshwaters*

David W. Schindler is a Killam Memorial Professor of Ecology at the University of Alberta. His work has been widely used in formulating ecological management policy in Canada, the U.S., and Europe.

Essay: *The Ovum's Secret*

Marc-André Sirard is a professor in the Department of Animal Sciences at Université Laval. He has devoted his career to the study of the oocyte, a "wonderful and immortal cell." He is the founder and director of the Research Centre in Reproductive Biology, and is co-founder of TGN Biotech, a biotechnology company based in Ste-Foy, Quebec.

Essay: *The New Millennium Model for Health Care and Research*

Robyn Tamblyn is an epidemiologist and Associate Professor at McGill University's Faculty of Medicine. She has devoted her career to developing and evaluating ways to

improve health care delivery. Dr. Tamblyn has made distinctive and original contributions to science in the areas of prescription drug use and medical education.

Essay: *Preventive Approaches for the Engineering and Management of Technology: Bridging the Gap Between Intellectual Cultures*

Willem H. Vanderburg is a professor in the Department of Mechanical and Industrial Engineering at the University of Toronto. He is also the university's founding Director of the Centre for Technology and Social Development in the Faculty of Applied Science and Engineering. The centre's goal is to make future engineers more socially and environmentally aware in order to enable them to create more context-compatible technologies.

Essay: *Social Proprioception—Understanding the Health of Canadians*

Michael C. Wolfson is Assistant Chief Statistician, Analysis and Development, at Statistics Canada. He is responsible for analytical activities in general, for health statistics, and for specific analytical and modeling programs.

Essay: *Molecular Devices: The Next Technological Revolution*

Robert Wolkow is considered a leading figure in the new field of nano-scale science. He is currently a research officer of Molecular Interfaces at the National Research Council—where he started a scanning tunneling microscopy group.