



Chapter 3: Partnerships — Expanding the Circle of Excellence

ONE OF THE KEY OUTCOMES OF MRC'S STRATEGIC PLANNING PROCESS OF THE EARLY 1990S WAS THE DECISION TO PROMOTE THE DEVELOPMENT OF ACTIVE PARTNERSHIPS WITH INVESTIGATORS, HEALTH CARE PROVIDERS, UNIVERSITIES, RESEARCH CENTRES AND INSTITUTES, FOUNDATIONS, AND PROVINCIAL GRANTING AGENCIES AND GOVERNMENTS. IN ADDITION, MRC FOCUSED ON STRENGTHENING ITS PARTNERSHIPS WITH INDUSTRY. TODAY, THE MRC HAS 60 PARTNERSHIP AGREEMENTS IN PLACE WITH THE VOLUNTARY AND NOT-FOR-PROFIT SECTOR, FEDERAL AND PROVINCIAL GOVERNMENTS, INDUSTRY, AND INTERNATIONAL HEALTH RESEARCH ORGANIZATIONS.

Over the past several years, the partnerships that MRC has established have helped to attain several strategic objectives. They have:

- brought together voluntary organizations, industry, and academia to promote a common agenda of investment in health research
- fostered better coordination and planning of common efforts
- increased the use of peer review to ensure that the best science is funded

- facilitated linkages between researchers and other sources of research funding, including voluntary organizations and researchers
- functioned as a mechanism for linking government health policy with health research on issues of national importance, such as AIDS and breast cancer.

Preserving excellence while generating new investments

Five principles have guided the MRC in its partnership development:

- Research projects must be related to health and must add value to the ongoing health research effort.
- Partnerships must have a national perspective, open to anyone in Canada, and not specific to an institution or university.
- Every project funded through an MRC partnership must first meet internationally accepted standards of excellence, as determined through the MRC's peer review process.

- Partnerships must provide a significant contribution for every dollar of MRC investment.
- Partnerships are to command no more than 10 per cent of the total MRC budget.

MRC's decision to pursue partnerships with the voluntary sector, with industry, with government, and with international organizations has contributed to a dramatic increase in the amount of money invested in health research in Canada. Research spending by pharmaceutical companies alone increased more than eight-fold between 1987 and 1997. In 1999–2000, MRC invested approximately \$21 million in partnerships, with partners contributing nearly \$62 million. These partnerships will result in approximately 724 grants and 749 personnel awards for Canadian researchers.

All partners benefit

MRC partnerships have created benefits for the Council, for its partners, for researchers, and for Canadians over the past decade.

For the MRC, partnerships provide added recognition and visibility with the voluntary sector. Many voluntary organizations have strong lobby groups and are active in advocating increases to the government's investment in health research. Partnerships also link

the MRC to large corporate sponsors, increasing the potential for future collaborations.

Partners benefit through their access to the MRC's system of peer review. Knowing that research has met accepted standards of excellence provides confidence and assurances to health research investors that they are funding good science. Organizations are more able to focus their efforts on raising funds for research, without having to use valuable resources in administering their own peer review process. In addition, MRC partnerships help to link voluntary agencies with researchers and personnel, helping them to identify champions in their area of interest.

Researchers benefit directly from partnerships, because of the increased number of grants and awards available to Canadian scientists. Partnerships, particularly those with industry, help to create high-quality employment for the researchers who are being trained in Canada's universities.

Finally, Canadians benefit — from increased research capacity in targeted areas of research that translates into better ways to prevent and treat disease; from increased dissemination of research results through voluntary and provincial government organizations and their networks; and from the economic growth and job creation that result from being able to commercialize the result of Canadian research in Canada.

MRC partners: The voluntary sector

More than half of MRC's partnerships have been developed with the voluntary sector, including charitable and not-for-profit organizations. These organizations play an important role in Canadian health research, raising funds, supporting research, and disseminating research results to citizens. Partnerships with the voluntary health charities are resulting in increased coordination and planning of common efforts in building the health research capacity in Canada, with the ultimate goal of delivering the benefits of research to Canadians.

Examples of MRC partnerships with the voluntary sector are:

- The **Juvenile Diabetes Foundation (JDF)/MRC Partnership**, is a program investing in research to find a cure for this devastating disease and prevention of its complications. This program has made investments totalling \$13 million, of which \$9 million has come from the Juvenile Diabetes Foundation and \$4 million from the MRC.
- **Canadian Breast Cancer Research Initiative:** MRC contributes \$10 million over five years to this initiative, which is jointly run with the National Cancer Institute of Canada (NCIC), the NHRDP, the Canadian Cancer Society, the Avon Flame Foundation, and the Canadian Breast Cancer Foundation. The initiative supports a broad spectrum of

cancer research in Canada relevant to the prevention, early detection, diagnosis, treatment, rehabilitation and palliation for people with breast cancer. The ultimate goal of the program is to prevent, cure, and eradicate breast cancer and to enhance the lives of women living with the disease.

JDF/MRC funds research networks

Diane T. Finegood, of Simon Fraser University in B.C., **Terry Delovitch** and **Bhagirath Singh**, of the University of Western Ontario, **Alex Rabinovitch**, of the University of Alberta, and **Catherine Whiteside**, of the University of Toronto are leading research networks that are seeking better ways to prevent and treat diabetes.

The network of Dr. Delovitch and Dr. Singh focuses on the molecular mechanisms of the development of insulinitis and its regulation in insulin-dependent diabetes mellitus (IDDM).

Dr. Finegood's network focuses on preventing the death of beta-cells, the only cells in our body that make insulin. Type 1 diabetes occurs when the beta cells in the pancreas are destroyed by an autoimmune reaction.

Dr. Rabinovitch's network is focusing on developing and testing strategies to prevent or block immune system rejection of pancreatic islet grafts that are transplanted to treat Type 1 diabetes. The strategies will focus both on the islet donor and the islet recipient.

Dr. Whiteside's network studies the cellular and molecular mechanisms related to renal complications of Type 1 diabetes.

- The **Canadian Neurotrauma Research Program**. This program funds basic and applied research and trains personnel in neurotrauma research. Partners with MRC in this initiative include the Rick Hansen Institute, the Canadian NeuroScience Partnership, the Regeneration Tour Society, the Alberta Paraplegic Foundation, the British Columbia Neurotrauma Initiative, the Manitoba Neurotrauma Initiative, the Ontario Neurotrauma Foundation, and the Newfoundland/Labrador Neurotrauma Committee.
- The **K.M. Hunter/MRC Doctoral Research Awards Program**, a partnership with the K.M. Hunter Charitable Foundation of Peterborough, Ontario. The partnership will support 31 students with exceptionally high potential for future research achievements in the areas of Alzheimer's disease, arthritis,

asthma, cancer, glaucoma, heart disease and stroke, multiple sclerosis, or schizophrenia.

- The new **Partnership Challenge Fund**: Through this program, launched in 1998, MRC has established partnerships with Canada's health charities to bring together federal investments and charitable donations to work in communities toward better health for Canadians. Since then, close to 200 new awards have been made in partnership with 33 organizations, including the Canadian Lung Association, the E.B. Baker Foundation for the Prevention of Blindness, the Heart and Stroke Foundation of Canada, and the Huntington Society of Canada. Their investment of \$3.4 million over two years will train about 80 people in all fields of health research, in accordance with the objectives of the partner organizations.

MRC partners: Governments

At the government level, MRC participates in partnerships to respond to priority health issues. These include:

- The **Canadian Health Services Research Foundation (CHSRF)**: The CHSRF was established at the urging of the MRC to undertake research to improve the delivery of health care through Canada's health care system. Through its work, to which MRC contributes \$2 million per year, the CHSRF is

helping to establish evidence-based decision-making as an integral part of doing business (see Chapter 4).

- **Canadian Strategy on HIV/AIDS:** MRC has been a key partner in the federal government's strategy on HIV/AIDS since 1993, through a collaborative initiative with the NHRDP. The collaboration supports research in a variety of areas, including population health, risk management, clinical management, and biomedical sciences.

AT THE UNIVERSITY OF WESTERN ONTARIO, RESEARCHERS ARE TRYING TO UNDERSTAND THE BIOLOGICAL MECHANISMS THAT CAUSE AIDS PATIENTS TO HAVE SIDE EFFECTS FROM DRUGS USED TO TREAT AIDS-RELATED ILLNESSES, SUCH AS PNEUMONIA.

- A joint Health Canada/MRC initiative worth more than \$18 million to fund research on **Hepatitis C**: The initiative, which will also leverage funds from other funders, will focus on research into preventing Hepatitis C, as well as research on quality-of-life issues and evaluations of existing treatments and patient care.
- **Genome Canada:** Following the completion of the Canadian Genome Analysis and Technology Program in 1997, the MRC created the Genome Task Force to prepare and implement a national, multi-partnered initiative, Genome Canada. The MRC

has provided \$5 million per year for five years to kick-start the initiative and attract other partners to realize the goal of a \$50-million-per-year-research program.

- **MRC Regional Partnerships Program (RPP):** This program provides up to \$22 million over a five-year period to researchers in the six provinces that have historically received the smallest portion of MRC funding – Manitoba, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, and Saskatchewan. The RPP matches funds invested at the institutional level, and, in Manitoba and Saskatchewan, funds invested by the provincial government. These are new funds for health research. The RPP supports a strategic planning process to establish research priorities and partnerships, build on local strengths and priority interests, and recruit promising and/or excellent scientists.

MRC partners: Industry

The most significant of MRC's partnerships with industry began in 1993, with the creation of the **MRC/Rx&D Research Program** with Canada's 59 Research-Based Pharmaceutical Companies (formerly known as the Pharmaceutical Manufacturers' Association of Canada). This innovative program, originally called the MRC/PMAC Health Program, was the first of its kind, not only in Canada, but throughout the world. The strategic alliance increased cooperation and collaboration between academic researchers and the pharmaceutical industry, and created a greater understanding of the role of each in the cycle of innovation. The mutual respect that has developed between these two crucial partners in the health research enterprise has meant that the MRC/Rx&D Research Program has achieved results well beyond its financial support for health research.

Michael Hayden, of the University of British Columbia, is receiving funding from MRC and Merck Frosst through MRC/Rx&D for his mega-project in expanding our knowledge of molecular medicine, in particular the genetics of cell death (apoptosis) and neurodegeneration. His work will make important contributions to our understanding and treatment of conditions such as Huntington's Disease.

In its first five years, the MRC/Rx&D Research Program committed \$237 million in health research (\$205 million from Rx&D and \$32 million from MRC), funding more than 1,000 projects, including eight mega-projects, 50 clinical trials, and nearly 1,040 full-time equivalent positions for research assistants, technicians, graduate students, post-doctoral students, and other related positions in Canadian universities, hospitals, and research institutes. The program has led to the discovery that a new drug used to treat and prevent heart attacks and angina, Hirudin, is more effective at reducing deaths and further heart attacks than is the standard drug treatment. MRC/Rx&D has also funded four Clinical Research Chairs in Women's Health.

Chairs in Women's Health

Canada's first Chairs in Women's Health were created in partnership with Wyeth-Ayerst Canada Inc. to facilitate or lead multidisciplinary approaches to study critical issues in women's health, to stimulate research and develop standards for clinical excellence in the study of women's health issues, and to champion women's health as a field of medical research.

The first four holders of Chairs in Women's Health are:

- **Harriet McMillan** (McMaster University), studying the relationship between child maltreatment and psychiatric disorder in women across the life span
- **Hans Zingg** (McGill University), studying new approaches to the physiology and pathophysiology of parturition
- **Ruth McPherson** (University of Ottawa), studying prevention of cardiovascular disease in women
- **Bryan Richardson** (University of Western Ontario), studying fetal brain metabolism: biological and pathological development

Award and grant recipients under the program are all academic researchers, and all projects are peer-reviewed by the MRC, using MRC criteria. Projects must demonstrate scientific merit in order to be funded, with industry providing 80 per cent of funding and the MRC providing 20 per cent. All funds are directed to and expended under the direction of scientists in academic health centres in Canada. The program encompasses training, salary support, basic research, and clinical research.

The **AstraZeneca Research Award** program is a multi-million initiative operated through Rx&D. The award is designed to fund two-year basic research projects by young scientists across Canada. **Nicola Jones** was a 1997 award winner. Today, she is an assistant professor at the Department of Pediatrics at the University of Toronto and a clinical scientist at the Hospital for Sick Children.

This partnership has resulted in many innovative studies, including research into pain in newborn babies and into gene function according to their location. The program has also funded clinical trials to test promising new treatments for diseases such as Alzheimer's disease, Hepatitis C, and HIV.

Phase II of the program was launched this year, with both parties pledging to significantly exceed Phase I funding. Among the new initiatives to be undertaken are University–Industry Research Chairs with funding up to \$140,000 per year plus operating funds. Phase II of the MRC/Rx&D Research Program will help to create a viable research environment to attract and retain the best scientists in Canada and will help to stimulate and increase investment in Canada by both the pharmaceutical and biomedical industries. It is an excellent example of the kind of innovative health research partnerships that benefit both the participants and the people of Canada.

Preventing premature death

The MRC/Rx&D Heart Outcomes Prevention Evaluation Study (HOPE Study), funded in partnership with Hoechst Marion Roussel Canada and chaired by Dr. Salim Yusuf, found that using the anti-hypertensive drug ramipril substantially improved survival after heart attack and lowered the risk of subsequent heart attacks. **Application of these findings could prevent one million premature deaths, heart attacks, and strokes each year.**

Other MRC–industry partnerships include:

- The **University–Industry Program**, which has provided an opportunity for researchers to work in closer cooperation with non-Rx&D companies since 1987.
- The **Canadian Medical Discoveries Fund (CMDf)**, a venture capital fund to assist researchers in commercializing their research discoveries. CMDf, which resulted from an MRC vision, is an important venture capital investor in Canada's life sciences sector (see Chapter 4).
- The **Life Science Research Investment Initiative**, a strategic partnership supported by the MRC, Investment Partnerships Canada, and the Life Sciences Branch of Industry Canada. Its role is to promote excellent Canadian medical science to companies in the United States, Europe, and Japan.
- **Networks of Centres of Excellence (NCEs)**, unique partnerships among industry, universities, and government that bring together excellent research and industrial expertise. The MRC contributes financial support to the seven Health and Biotechnology NCEs: the Canadian Arthritis Network, the Canadian Bacterial Diseases Network, the Canadian Genetic Diseases Network, the Protein Engineering Network, HEALNet — Health Evidence Application and

Linkage Network, the Canadian Stroke Network, and the Canadian Network for Vaccines and Immunotherapeutics of Cancer and Chronic Viral Diseases (CANVAC).

International partnerships

It is said that research knows no boundaries. Nonetheless, international comparisons are inevitable. Canada accounts for only four per cent of the world's health research, but the excellence of Canadian research, and the international reputation for excellence of our peer review system, make Canada a desired partner in international collaborations. In turn, Canada gains access to more research funding, which creates new training opportunities, and reinforces the strengths of domestic health sciences research.

The MRC's international partnerships include:

- The **International Human Frontier Science Program (HFSP)**: A partnership among Japan, the United States, the United Kingdom, the European Commission, France, Germany, Italy, and Switzerland, as well as Canada, to support international collaborative research and research training in the neurosciences and molecular biology. The program also supports international scientific meetings to explore rapidly developing fields of research. Canada contributes


approximately \$700,00 each year (half each from MRC and NRC), while Canadian scientists obtain \$1-2 million in research funding from HFSP.

Among Canadian researchers who have received funding from the Human Frontier Science Program are the following winners of the 1998-99 competition:

- **John Randall Flanagan** (Queen's University) and **John F. Kalaska** (Université de Montréal), for their study of internal models for multiple tasks in sensorimotor control
- **Alan Kingstone** (University of Alberta) and **Patricia Ann McMullen** (Dalhousie University), for their study of subcortical mechanisms of vision
- **Stephen W. Michnick** (Université de Montréal), studying TGF β signal transduction from cell surface to nucleus
- **Serguei Steinberg** (Université de Montréal), for his study of the importation of RNA into mitochondria: mechanism and biomedical significance

- The **Japan Canada Neuroscience Partnership:** This partnership is designed to facilitate world-class research through collaboration between Canadian and Japanese neuroscientists. The partnership focuses on developing contacts between the two countries and on developing programs to facilitate movement of trainees between the two countries.
- **Canada Singapore Exchange Program:** The MRC and the Institute of Molecular and Cell Biology of Singapore have an agreement to support research and development activities in both countries, with a focus on cancer, infectious diseases, and the development of cutting-edge vaccines.
- The **Burroughs Wellcome Student Research Award:** This partnership between the MRC and the Burroughs Wellcome Fund supports in the areas of medicine, dentistry, pharmacy, and the health sciences. The Burroughs Wellcome Fund is an independent, private foundation based in North Carolina that supports research and other scientific and educational activity in the medical sciences.





Chapter 4: Health Research: – Strengthening the Health Care System, Strengthening the Economy

HEALTH RESEARCH HAS TRADITIONALLY BEEN SEEN AND UNDERSTOOD AS A KEY FACTOR IN IMPROVING THE HEALTH AND WELL-BEING OF PEOPLE. HEALTH RESEARCH HAS HELPED TO PREVENT DISEASE AMONG PEOPLE AND TO TREAT IT MORE SUCCESSFULLY WHEN IT OCCURS.

Over the past decade, decision-makers have come to understand the role health research can play in two other important areas of Canadian life. Health research has an important role to play in ensuring that our health-care system operates efficiently and cost-effectively to meet the health needs of Canadians. It also serves as a catalyst for economic growth.

Canadians understand this. Recent public opinion research has found that 79 per cent of Canadians believe funding for health research should be increased in order to bring about improvements in population health and enable Canada to reap the economic benefits of sharing its discoveries with the rest of the world.

As part of the redefinition of the role of MRC that took place in the first half of the 1990s, health services research and realizing the economic benefits of Canadian research discoveries have both become important foci of MRC activity.

A focus on research

Canadians know that money invested by the federal government in health research through the MRC is spent on exactly that — health research. For every dollar committed by the federal government, a minimum of 95 per cent is invested in excellent research carried out by Canadian researchers. Indeed, at no time in the history of MRC have administrative expenses exceeded 4.7 per cent of its total budget. The MRC's stringent control over administration costs means that more research can be funded, and more life-saving discoveries may be realized.

These figures do not tell the whole story of the federal investment in health research. When funding acquired through MRC partnerships is factored in, every federal tax dollar invested in the MRC translates into \$1.36 spent on MRC-supported research.

Improving the health of the health care system

Our health care system is prized by Canadians. It is a national symbol that, in the minds of Canadians, sets us apart from the United States, and one of which Canadians can justly be proud. Yet, over the past several years, Canadians, faced by long waits for treatment, bulging emergency rooms, and a perceived lack of resources, have felt growing concern about the ability of our health care system to continue to meet our health needs and those of our families in the future.

As Canada works to renew its health system, it is clear that research must be at the heart of the renewal process. Investments in health research enable us to determine the elements that contribute most to the health of Canadians. Research also provides a solid base of evidence for public health policies, and for the funding and management of health services.

Health care in Canada is an \$85-billion per year industry. Until recently, however, there has been little evidence on which to evaluate how effective the health care system has been at maintaining and improving the health of Canadians, and little evidence of whether the money spent has been spent wisely and well. In fact, some have questioned the effectiveness of many

interventions in the health care system and whether expensive forms of intervention are favoured over less costly, but equally effective, alternatives.

Increasingly, there is more interest in the need for research on outcomes. Conducting a more rigorous evaluation of everything we do, from therapies to training systems and research methods, can generate important new efficiencies while revealing new opportunities. In the words of the National Forum on Health, “applying the best available evidence in the decision making process does not guarantee good decisions or outcomes, but it does improve the odds of achieving both.”

Health Care Services Research

- A study by **Paul Hébert** of more than 800 patients admitted to intensive care at the Ottawa General Hospital demonstrated that it was possible to transfuse less blood and obtain similar or even better results. This study marked the first time that traditional blood transfusion practices had been called into question, and led directly to a more efficient use of limited blood supplies.
- **David Naylor**, of the Institute for Clinical and Evaluative Sciences in Toronto, combines clinical practice, health

services research, and health policy evaluation to create a blueprint for a more effective and efficient health care system. His research with patients suffering from heart attacks has included important assessments of the timelines, use, and cost-effectiveness of drugs used for treating heart attack victims.

- **Morris Barer**, of the University of British Columbia, is assessing the reliability and validity of waiting list size and time data for selected surgical procedures in British Columbia. Access to waiting list data that are obtained uniformly at different sites and times is essential in determining how well the health care system is providing care to Canadians.
- **Claude Sicotte**, of the Université de Montréal, is investigating how physicians incorporate telemedicine into their clinical practice. Given the large potential of telemedicine for delivering improved quality of care to remote communities at low cost, it is vital to discover how it can be most effectively used by physicians and other health care providers at both the central and the remote site.
- **Susan Jaglal**, of Toronto's Sunnybrook Hospital, is determining the effectiveness of a program that allows elderly patients with hip fractures to be discharged earlier

from hospital to begin rehabilitation in the comfort of their own homes. Besides reducing costs, this program has the potential to improve the quality of life for these Canadians while they recover from their injuries.

Since 1992, MRC has progressively increased funding for health services research. In 1999–2000, MRC invested \$18.3 million in health research (including population health and psychosocial and behavioural research, as well as health services research). Partner contributions brought the total to \$20.2 million — the largest such investment of any federal research organization.

These funds are invested in different programs, in many of which MRC plays a leading role. For instance, primarily as a result of MRC's effort, the federal government established the Canadian Health Services Research Foundation (CHSRF) in its 1996 budget. Its initial endowment of \$65 million was increased to \$100 million in 1999. As a founding partner in CHSRF, MRC contributes \$10 million over five years, and is represented on the foundation's board of directors.

"The mission of the Canadian Health Services Research Foundation is to sponsor and promote applied health systems research, to enhance its quality and relevance, and to facilitate its use in evidence-based decision making by policy makers and health systems managers."

CHSRF funds research related to health systems to assist policy-makers in evidence-based decision making. All research proposals funded by CHSRF must meet standards of excellence as judged through the peer review process.

CHSRF also administers the NURSE Fund, a \$25 million fund announced in the 1999 federal budget to finance research on issues related to nursing and the delivery of health care. The fund is being used to create Nursing Research Chairs, to provide training to increase Canada's capacity in nursing research, to fund specific research projects, and to disseminate research findings to nurses.

MRC also provides financial support to HEALNet (the Health Evidence Application and Linkage Network), a Network of Centres of Excellence that focuses on enhancing the use of information in health-care decision making. The Network received \$1.8 million in 1999–2000. MRC also invests in health services research through

the Genomics Research Program, the Canadian Breast Cancer Research Initiative, and the HIV/AIDS program (see Chapter 3).

Canadians value the creativity and imagination that scientists bring to their work. Now, through bodies such as CHSRF and HEALNet, we can be equally creative and imaginative about how we organize funding of our health care system to deliver services to Canadians in a way that meets their needs and priorities.

Health research: A catalyst for economic growth

Did you know?

With 1,100 employees, the Centre de recherche du Centre Hospitalier de l'Université Laval is the second largest employer in Quebec City, after the provincial government.

Canada's record of excellence in health research has improved the health of people around the world. But its benefits do not stop there. Canadian health research is also a powerful engine of economic growth and a growing source of high-quality jobs, and will continue to be so in the knowledge-based economy of the 21st century.

The life sciences sector of the Canadian economy grew 41 per cent between 1990 and 1997. It now accounts for 86,000 jobs in Canada — many more than its closest competitor, the aerospace industry, at 64,000 jobs. And by 2003, life sciences are expected to account for 136,500 jobs — an increase of more than 50 per cent in just four years. Already, there are more than 100 publicly listed Canadian companies in the life sciences, with a market value of close to \$15 billion. In 1996, the five MRC-supported NCEs announced the creation of 23 new spin-off companies.

Value for Money

Research has an impact on productivity, usually through the new products or processes that result from new knowledge and/or through reductions in the cost of supplying an existing service such as health care.

Economists assess the value of this impact by calculating the returns delivered by the research investment. Specialists in R&D assessment agree that private investment in R&D provides an average 20 to 30 per cent annual rate of return and a much greater return to society overall. Social rates of return from research average about 50 per cent.

The potential for growth in this area is huge. As of January 1, 1999, Canadian biopharmaceutical companies had 311 products under development — 311 products that have the potential to improve the health and well-being of Canadians, to provide high-quality employment to many thousands of people and contribute to Canada's economic growth, and to help to make Canada internationally competitive in the 21st century.

One of the most important developments of the 1990s has been the increasing ability to commercialize these research discoveries here in Canada. The Canadian Medical Discoveries Fund was created in 1994, in large part due to the commitment and efforts of London's Dr. Cal Stiller. This venture capital fund has raised more than \$250 million from nearly 60,000 Canadian investors, making it one of the largest investors in the life sciences in Canada. To date, it has directly invested \$178 million in close to 40 Canadian companies to bring new technology, health care products, medical devices, and pharmaceuticals to market — creating more than 500 jobs in the process.

In the 1980s, **Francisco Bellini** received a small government grant to explore an idea.

Today, the drug Dr. Bellini developed, 3TC, has dramatically reduced AIDS deaths worldwide, and BioChem Pharma, the company he started, is one of the largest biotechnology companies in the world, with a capitalization of more than \$4 billion and more than 1,500 employees. The company also discovered and manufactures Zeffix, a once-daily oral treatment for chronic Hepatitis B.

Its vaccine arm, BioVac, is the only vaccine manufacturing plant in Canada, manufacturing influenza and meningitis vaccines.

WorldHeart Corporation of Ottawa, Ontario is just one example of how research support from the MRC, health charities and others helped health researchers at the Ottawa Heart Institute achieve world prominence in the design of devices to assist ailing hearts. In 1989, a multidisciplinary team of health professionals and engineers, led by Dr. Wilbert Keon and Dr. Tofy Mussivand, began the development of what is essentially a fully implantable artificial heart. Their work was based on basic research in the functioning of

heart muscles, nerves and vessels, the performance of cardiac tissues under the stress of surgery, and factors affecting the successful acceptance of implants.

In 1996, WorldHeart Corporation acquired worldwide rights to the device developed by Drs. Keon and Mussivand and their team at the Ottawa Heart Institute. WorldHeart currently has more than 70 employees and is publicly traded. The commercial potential of the ventricular assist device in the global market is significant.

Academic research spawns commercial success

- Winnipeg's **Allan Mutch** and **Gerry Lefevre** are partners with the University of Manitoba and the Crocus Investment Fund in Biovar Life Support Inc., which is bringing to market their invention of devices to help patients undergoing heart bypass surgery.
- Through Apoptogen, Ottawa's **Bob Korneluk** and **Alex McKenzie** are using the knowledge generated by their academic research to provide new hope to cancer and stroke victims — and using the profits to support their further research and to train new young scientists.

- UBC's **Bob Hancock** focuses his research on cationic peptides, which act rapidly against all types of bacteria, including the antibiotic-resistant superbugs. Vancouver's Micrologix Biotech is testing cationic peptides for treating acute acne and preventing infections from catheterization. Results of a preliminary clinical trial indicate that its lead antibiotic peptide, MBI226, is safe and well-tolerated, eliminates 99.9 per cent of bacteria commonly found on the skin, and prevents bacterial growth on catheters. As a result of its work in this area, the company has grown to more than 40 employees, has raised \$30 million in capital, and is traded publicly.
- **Cromedica**, created by researchers from the University of Ottawa, today has employees located around the world, running international clinical trials for pharmaceutical companies.
- **Quadra Logic Technologies**, in Vancouver, manufactures photofrin, an anti-cancer drug that works by sensitizing cancer cells so that they can be destroyed by a safe form of radiation. **Julia Levy**, one of the company's founders, and today its Senior Vice President and Chief Scientific Officer, was a co-discoverer of the new treatment.

- **DiagnoCure**, a Quebec City biotech company, has developed a highly accurate test that can detect early signs of prostate cancer, improving the chances of successfully treating the disease. Developed by **Yves Fradet**, the test spots a genetic "marker" for prostate cancer in urine, avoiding the need for painful biopsies.

As we move into the new millennium, it is clear that health research will continue to be a catalyst for Canada's economic growth and international competitiveness, while helping to maintain and improve the health care system that is such a source of national pride to Canadians.





Chapter 5: Creating and Sustaining Excellence for Tomorrow

THE STARS OF MEDICAL RESEARCH ARE NOT CREATED OVERNIGHT. THEY ARE THE PRODUCT OF SUSTAINED SUPPORT AS THEY TRAIN AND BUILD THEIR CAREERS AND REPUTATIONS, FROM STUDENT DAYS, THROUGH ADVANCED POST-DOCTORAL WORK, TO INCREASING RESEARCH INDEPENDENCE AND LEADERSHIP OF THEIR OWN LABORATORIES, IN TURN PROVIDING THE MENTORSHIP AND TRAINING TO CREATE THE NEXT GENERATION OF HEALTH RESEARCHERS.

Over the past 40 years, MRC funding has provided the support that has enabled the excellent researchers of today to reach their full potential, and the researchers of tomorrow to develop their skills and insights.

The Canadian researchers profiled here are but a few of those who will be at the forefront of research discoveries in the new millennium.

Online guidance for today's young scientists

Making the transition from a student to an independent researcher can be a difficult journey. Now, young researchers can get help from ***Science's Next Wave***, an online publication that provides information about scientific training, career development, and the job market in all research sectors.

MRC has purchased the Canadian site license for *Science's Next Wave*, to provide young researchers with free and unlimited access to this educational tool.

The next generation of Canadian research pioneers can find *Science's Next Wave* at <http://nextwave-ca.sciencemag.org/>.

- **François Auger**, professor in the Department of Surgery of



L'Université Laval, never wanted to limit his options; while in university, he studied both science and the humanities, and even contemplated a career in architecture. But once he started medical school, Dr. Auger realized he could make a greater impact in life as a scientist. "It's easier to be a

physician," he says, "and do some architecture on the side." Tissue engineering was a revolutionary concept when Dr. Auger founded the Laboratory for Experimental Organogenesis (LOEX) at l'Université Laval in 1985. Under his direction, he has seen LOEX grow from a sketchy dream into the first research group in Canada dedicated to the reconstruction of human tissues by human cell culture. He has grown complete skin, blood vessels, ligaments, cartilage, bronchi, and corneas in his university laboratory, and helped people with severe burns to survive. By designing novel ways to save Canadian lives, Dr. Auger has remained an architect at heart, while making science his primary activity. "I'm in the business of hope," Dr. Auger says. "This gives hope to things that seemed unrepairable over 25 years ago."

- In high school, **Susan P.C. Cole** had a passion for English



— until her final year of high school, when she landed a laboratory research job. Today, 28 years later, Dr. Cole, a professor in the Cancer Research Laboratories at Queen's University, is a trail-blazing Senior Career Scientist at the Kingston Regional Cancer Centre. How did she get there? "Victor Ling's

work inspired me," she says. In the late 1970s, Dr. Ling, now a senior researcher at the B.C. Cancer Control Agency, discovered that a protein found on the surface of drug-resistant cancer cells, called P-glycoproteins (P-gp), could pump drugs out of the cells. Dr. Ling's work revolutionized cancer research, because it forced scientists to look at the genetic make-up of drug-sensitive and drug-resistant cancerous cells. Once P-gp was analysed, it was believed that new treatments could be developed to bypass the drug resistance and combat cancer. In 1992, Dr. Cole added a new layer to Dr. Ling's work when she stumbled on another protein in cancerous cells that caused drug resistance. Multidrug resistance protein (MRP), which Dr. Cole co-discovered with Roger Deeley, shook the research world. "Sometimes we're referred to as the mother and father of MRP," she jests. Since her co-discovery of the protein, other variants of the MRP-family have been

discovered by other investigators around the world. Along with Dr. Deeley and her research team, Dr. Cole wants to biochemically dissect MRP and find out more about the function of MRP in normal cells so that more effective cancer treatments can be developed. As for her love of English, it's been put to good use in writing funding applications and more than 127 research papers. Dr. Cole's achievements are a model for Canadian women, especially those who don't have the itch for science until they feel the test tube in their hands.

- As a practising veterinarian, **Alastair Cribb** was intrigued by species-specific drug responses. Now he wants to know what genetic quirks make a relatively safe drug dangerous in some human patients. An MRC Scholar, Dr. Cribb holds doctoral degrees from the University of Saskatchewan and the University of Toronto. He has worked as a senior research



pharmacologist with Merck Research Laboratories in West Point, Pennsylvania. Today, Dr. Cribb is a professor of clinical pharmacology and director of the Laboratory for Comparative Pharmacogenetics at the University of Prince Edward Island, as well as being an adjunct professor in the Department of Pharmacology at Dalhousie University.

So why would this gifted researcher settle in Charlottetown, PEI, where scientific funding can be scarce? "There was a lot of opportunity for me to build something here," Dr. Cribb says. What he's building in Charlottetown could save thousands of Canadian lives. Dr. Cribb specializes in molecular toxicology. He analyzes effects of drugs on a molecular level, to understand why humans and animals experience adverse side effects — anything from skin rashes to fatalities. "I hope to make drugs safer," Dr. Cribb says. Working with sulfonamides, anti-convulsants, and anti-inflammatory drugs, as well as estrogen in breast cancer, Dr. Cribb and his research team at UPEI are attempting to unravel the genetic differences between individuals that influence susceptibility to drug and chemical toxicity. He looks forward to the day when people will hold "genetic credit cards" that let physicians know the safest and most effective drugs for each patient. Until that day comes, Dr. Cribb enjoys teaching his students the research keys needed to unlock the genetic mysteries of adverse drug reactions. "If you get involved in research and in training," he says, "you get other people involved, and you can leave a greater legacy."

- As a boy, **B. Brett Finlay**, now a professor in



biotechnology, biochemistry and molecular biology and a member of the Department of Microbiology and Immunology at the University of British Columbia, thought he would become a paleontologist. Much of this boyish enthusiasm had to do with digging in dirt and searching for dinosaur eggs, but it

also had to do with discoveries. “I loved figuring out how things work,” Dr. Finlay says. His enthusiasm for discovery remains undiminished. Along with his research team at UBC, Dr. Finlay has made a career out of trying to unlock the mysteries of bacterial pathogens known as *E. coli*, *Salmonella* and *Listeria*. He wants to understand how these three organisms attack intestinal cells, causing illness and sometimes death. Dr. Finlay’s research could lead to novel vaccines, diagnostics, and therapeutics to control these bacterial infections. Thousands of students from around the world learned about his groundbreaking research when he became the first Canadian invited by the Howard Hughes Memorial Institute (HHMI) to give a ‘virtual’ Holiday Lecture on science on the World Wide Web. With this prestigious honour under his belt, Dr. Finlay remains modest — and even retains a sense of

humour. “I was completely flabbergasted when (HHMI) asked me to do this,” he says, adding that he threw a few “eh’s” into his Holiday Lecture to make it more Canadian.

- **Marilyn Ford-Gilboe** is a nurse with a Ph.D. who finds her



inspiration in the participants in her research. Dr. Ford-Gilboe, an associate professor in the School of Nursing at the University of Western Ontario, believes that the family is critical in shaping how we learn to care for our health and to nurture each other, and that this process is affected by

the challenges that families face in their everyday lives. Together with colleagues from the University of Western Ontario and the University of New Brunswick, Dr. Ford-Gilboe is exploring how single mothers and their children learn to care for themselves and to create a new family life after leaving abusive partners. The research team is conducting in-depth interviews with 40 to 50 families. By constantly comparing the stories told by these families, the team is developing a “grounded” theory that explains how these families move beyond their experiences of abuse to deal with an uncertain future while nurturing each other and developing to their full potentials. Her

data come from interviews with single mothers and their children. “I’m in awe of the strength of these women,” Dr. Ford-Gilboe says. Single mothers and their children, she theorizes, have extraordinary adaptive qualities needed to meet the challenges of a new life. At the same time, the support of family friends, professionals, and “the system” is vital in helping them move ahead. For Dr. Ford-Gilboe and her research team, the study is a continuous learning experience. “You keep refining your ideas as you go to new participants,” she says. These new ideas about how single-parent families learn to care for themselves and the types of supports they need to do this, may help improve the lives of many single Canadian mothers and their children.

- To her colleagues, **C. May Griffith** is a respected, Harvard-educated research scientist, with a bachelor’s degree in zoology and human biology, a master’s degree in zoology, and a Ph.D in anatomy. Few people are aware that she also has earned a master’s degree in business administration — a “fallback” plan she’s unlikely to need. Dr. Griffith made headlines when she and her research team at the University of Ottawa Eye Institute constructed an artificial cornea (the



transparent sheath that covers the eye and protects it from the surrounding environment). As people age, their corneas tend to deteriorate. Initially, Dr. Griffith was studying human corneal deterioration, for which she had to grow corneal-like tissue. Her success inspired the idea of creating an artificial substitute. As described in *Science*, Dr. Griffith’s artificial cornea is constructed of three layers of cells and looks a lot like a contact lens. The artificial cornea still needs extensive testing, but Dr. Griffith’s discovery could lead to human transplants in the not-too-distant future and may eliminate the need for live animals in testing the toxicity of new drugs and other potentially irritating substances for the eye. When she talks about her work, Dr. Griffith, a selfless and enthusiastic researcher, is quick and to the point: “I want to make a difference.” Thanks to her, the vision-impaired may someday be able to appreciate the significant difference she has already made.



- Genetics first caught the interest of **Bartha Maria**



Knoppers in 1987. Dr. Knoppers, a highly respected lawyer whose specialties included human reproduction, wanted to understand the international and ethical implications of genetics and biotechnology. At that time, human genetics was a relatively new field.

With the encouragement of former MRC president Pierre Bois, Dr. Knoppers won a research grant that sent her on a novel research journey. In 1990, Dr. Knoppers produced a paper, "Human Dignity And Genetic Heritage", which has led her to genomes. Genomes are a collection of genes in living organisms that provide a blueprint toward their creation. DNA, or deoxyribonucleic acid, is the 'language' for this instruction. Genomic variations help researchers determine the construction of everything from a tree to a worm. Dr. Knoppers, currently a full professor in the faculty of law at l'Université de Montréal, examines the ethical implications of genomics. "Is the human being just another form of living matter?" she asks. This is an important question, because the Canadian government invests a lot of money in genomics, in areas ranging from human beings to forestry. Dr. Knoppers is currently undertaking an MRC-funded critical review of the ethical guidelines used for the storage of

biological materials in genetic research. In a short while, she expects to have drafted a model consent form for subjects undergoing human genetic research. Dr. Knoppers' ultimate goal is to integrate an internationally accepted, ethical model for genetic research, and to help calm the debate about the so-called dangers of genomics. "I presume that people are morally responsible," she says, "and that people have the desire to know the facts about something."

- Fernand Labrie**, the renowned endocrinologist from



l'Université Laval, enjoys scientific challenges. "I've always been interested in the quantitative aspects of things," he says. As a child, Dr. Labrie devoured science and mathematics books and participated in science fairs. As an adult, Dr. Labrie has revolutionized endocrinology

by introducing concepts that have changed the way people think about hormones and how hormone-sensitive cancers such as breast and prostate cancers are treated. Endocrinology is the study of hormones, which are secreted primarily from glands, and their subsequent effect on other organs. In 1969, while in Cambridge, England, Dr. Labrie purified hemoglobin messenger RNA, the first

messenger RNA of mammalian origin. In 1972, he founded the Molecular Endocrinology Research Centre at l'Université Laval. In 1973, the MRC recognized Dr. Labrie's research by funding the first MRC Group in endocrinology under his direction. Since then, he and the MRC Group have discovered and developed the use of LHRH agonists to achieve highly efficient but reversible chemical castration in men. This treatment is now used in more than 90 per cent of patients receiving hormonal therapy for prostate cancer in North America and Europe. With his MRC Group, he discovered combined androgen blockade, a treatment that blocks both testicular and adrenal sources of male hormones at the start of treatment. This first treatment shown to prolong life in men with prostate cancer has become standard worldwide. He and his Group also developed a pure anti-estrogen that may help to prevent breast and uterine cancer, as well as bone loss and cardiovascular disease in post-menopausal women. Dr. Labrie is currently investigating the area of *intracrinology* — a new field of endocrinology developed by his Group that describes the mechanisms whereby sex hormones are produced in large proportion in peripheral tissues of the human body. Understanding the genetic coding and control of expression of enzymes that transform inactive to active hormones, which can lead to the development

and/or more rapid growth of malignant tumours, could enable Dr. Labrie to design novel treatments to fight breast and prostate cancer. "Decreasing suffering and saving lives," he says, "that's the driving force in my life."

- More than 50 years ago, **Yves Lamarre's** younger sister



died from a rare spinal cord disease. Her death was devastating — but also his inspiration. "Certainly the reason I got into the central nervous system was the death of my little sister," he says. Today, Dr. Lamarre, a professor and researcher in physiology at l'Université de Montréal, is a cartographer,

charting out the untapped resources of the human brain. He's interested in the fundamentals of the brain: its principles and its endless possibilities. "I like to ask questions," he says, "and find out how the brain works." In the early 1970s, Dr. Lamarre discovered that essential tremors begin in the cerebellum, the lower part of the brain at the base of the skull. Researchers had believed that these tremors, which begin with rapid fire movements in the hand and then spread to arms, head, and legs, were spontaneous, but Dr. Lamarre proved that a monkey's cerebellum, much like the human cerebellum, produced essential tremors in conjunction with the brain stem. He

has also helped one woman who, 20 years before, had lost her basic motor skills in the space of about a week due to an inexplicable disease, to learn to sign her name on a cheque. Dr. Lamarre helped her train her brain to use her eyes. In other words, if she can see the paper, she can sign her name. The process took a couple of years, but succeeded without the use of drug treatments. "The more we know about the brain," Dr. Lamarre says, "some way, somehow, we can treat the disease." Dr. Lamarre's current research focus is to show that attitudes and concentration, once thought to be reserved for the upper lobes of the brain, are controlled in some way by the cerebellum. As a neurological cartographer, Dr. Lamarre is a scientist who thrives in uncharted research waters.

- As a high school student in Hong Kong, **Patrick Lee** considered two career paths: the arts or the sciences. He chose science. As a highly respected virologist and cancer biologist at the University of Calgary, Dr. Lee has championed the development of reovirus as a potential treatment for cancer. Reovirus, like all viruses, self-propagates and multiplies when it attaches itself to a host cell. With ordinary viruses, this can cause sickness due to infection. Reovirus,



though, kills cancerous host cells and leaves normal, healthy cells alone. Using reovirus is a novel approach to treating cancer, and Dr. Lee says that he and his team of scientists at the Cancer and Biology Research Group at the University of Calgary stumbled upon it quite accidentally. "Sometimes," he says, "major breakthroughs come from nowhere." Dr. Lee started studying the cell structure of reovirus in 1978, when he was completing his Ph.D. in biochemistry at the University of Alberta. In 1998, Dr. Lee first injected reovirus into mice with cancerous tumours, and discovered that the tumours almost totally regressed. As a result of Dr. Lee's discovery, human trials of reovirus, in the form of a drug called Reosyn, will start in May 2000 at the Tom Baker Cancer Centre in Calgary. If the trials work, Reosyn could be used to fight malignant breast, lung or even neck tumours. It is uncertain if this virus will prove to be the magic bullet that kills the cancer demon, but Dr. Lee sees a lot of hope in his discovery. Canadians can be thankful that Dr. Lee's curiosity led him to a career in science.

- As a clinical nurse in the 1980s, **Sandra M. LeFort** helped ‘chronic pain’ patients who suffered from back aches or sleep deprivation. She became tired of seeing other people suffer, though, and decided to develop a solution. In 1990, Dr. LeFort went back to school and earned a Ph.D. in Nursing at McGill University.



Inspired by the work of Dr. Kate Lorig, and her program to help people cope with arthritis in the United States, Mrs. LeFort wrote her doctoral thesis on chronic pain. “I was interested in a community-based program that would be accessible in all areas of Canada,” she says. In 1997, her doctoral dream came true. Using a case study of 110 people from St. John’s, Newfoundland, Dr. LeFort tested her “Chronic Pain Self-Management Program”. Half the group participated in the 12-hour self-help program of exercise and time management, while the control group did not. In 1999, the study’s results showed that those who followed Dr. LeFort’s program improved their quality of life. Based on that research success, Dr. LeFort, currently an associate professor in the School of Nursing at Memorial University, won an MRC grant to develop a second study that includes 286 people. Chronic pain patients from Newfoundland and Ontario have been chosen to test whether the program works in large cities

as well as it does in smaller communities. The study will be administered by the Victorian Order of Nurses for Canada (VON Canada), a federally registered charity and national health care organization, made up of about 8,000 nurses, that has been caring for Canadians in their own homes, local communities and workplaces for more than 100 years. For the next two years, Dr. LeFort will teach these nurses how to administer her 12-hour program and help chronic pain sufferers help themselves. Dr. LeFort is looking beyond the boundaries of this study. “I’d like to see the VON pick up this program and disseminate this across Canada,” she says.

- It started with Isaac Newton. **Victor Ling**, now Vice-President of Research at the B.C. Cancer Agency and the B.C. Cancer Research Centre, read about Newton’s theory of gravity, while he was still in public school. But it wasn’t the falling apple that intrigued Dr. Ling, it was the questions that Newton asked. “He saw an apple fall,” Dr. Ling says. “He



questioned it. Why does it fall down? Why doesn’t it fall sideways?” These kinds of intellectual questions have inspired Dr. Ling throughout his research career. And it’s thanks to his curiosity that the world now knows about a

protein called P-glycoprotein. In the early 1980s, while studying how cancer cells mutated and multiplied, Dr. Ling discovered that some cells resisted anti-cancer medication. At that time, he was a researcher at Toronto's Princess Margaret Hospital. "If these cells were able to be resistant to anti-cancer drugs," Dr. Ling realized, "wouldn't this be important to cancer patients?" Inspired by his own research question, Dr. Ling went down to the hospital pharmacy, bought a number of anti-cancer drugs, and proceeded to test the resiliency of the cancer cells. Dr. Ling discovered that some cells rejected the drugs because of P-glycoprotein. Today, his research focuses on chemotherapy resistance. Dr. Ling's discovery of P-glycoprotein has both revolutionized cancer therapy and inspired other researchers to build on his work. Susan P.C. Cole, a renowned cancer scientist from Queen's University, is one of his unabashed fans. Dr. Ling appreciates the respect, but emphasizes that breakthroughs don't just happen. "You always have to build on your predecessors," he stresses.

- As a 10-year-old boy, **Hyman Niznik** received a special issue of *Life* magazine that focused on the human brain. "It was at that point that I realized this is where it's at," says Dr. Niznik. Today, Dr. Niznik is an associate professor in Psychiatry at the University of Toronto and a Principal Investigator at the Centre for Addiction and Mental Health. His primary interest is unlocking the mysteries of mental illness, particularly schizophrenia. Since 1986, under the guidance of his mentor, Dr. Philip Seeman from U of T, Dr. Niznik has been attempting to understand the role of excess dopamine in schizophrenia. Dopamine is a natural chemical protein produced by the brain, which, in combination with GABA proteins (which regulate learning, memory, and emotion), produces erratic "communication" behaviour in people with schizophrenia. For years, drug treatments have interrupted the communication between dopamine receptors (called neurotransmitters) and GABA proteins. Along with his research team at U of T, Dr. Niznik has successfully cloned dopamine receptors from both schizophrenic brain tissue and normal brain tissue to better understand dopamine receptors' genetic makeup. His ultimate goal is to develop a cure for schizophrenia.



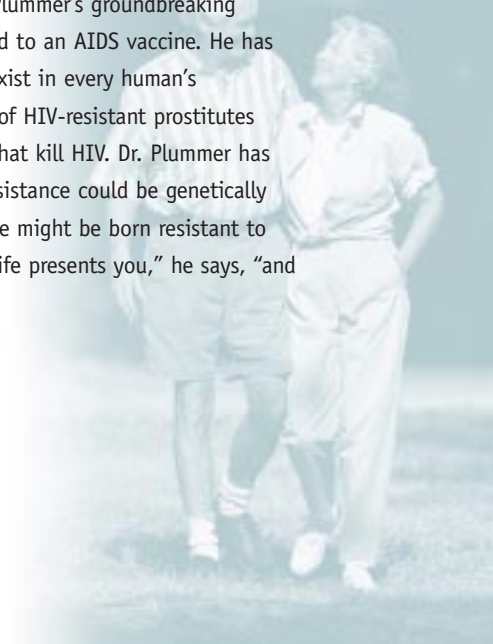
Recently, Dr. Niznik made a major discovery — that dopamine doesn't interact with GABA proteins. Nonetheless, his research into the genetic structure of dopamine receptors has enabled Dr. Niznik to better understand its nature. "We need to know the basic biology of the gene," he argues. This, he says, will lead to the creation of novel treatments to fight schizophrenia, creating a better life for the one in one hundred people and their families who suffer from schizophrenia.

- He was in the right place at the right time. In 1979,



Francis Plummer was a young researcher specializing in infectious diseases, just three years out of medical school at the University of Manitoba, when he was offered the opportunity to go to Nairobi, Kenya. "I took it for the travel experience," Dr. Plummer says, "and the adventure." Initially, Dr. Plummer's research interests lay in gonorrhea. But as AIDS began to claim thousands of Kenyan lives, he turned his attention to HIV. In 1984, Dr. Plummer returned to Canada and was offered both a job at the U of M and the opportunity to go back to Kenya permanently. By then, he had fallen in love with

the country and had grown to care about its people. He accepted the offer, and since then he's been trying to unlock the mysteries of HIV on behalf of the university. Using a case study of about 100 prostitutes in Nairobi, Dr. Plummer has discovered that some people can be immune to HIV. He wants to understand two things: how these people are protected from the virus, and why they're so special. The results of Dr. Plummer's groundbreaking research could possibly lead to an AIDS vaccine. He has found that T-cells, which exist in every human's bloodstream, in the blood of HIV-resistant prostitutes have certain mechanisms that kill HIV. Dr. Plummer has also found out that HIV resistance could be genetically determined, so some people might be born resistant to the virus. "You take what life presents you," he says, "and you run with it."



- As a boy, **Judes Poirier** wanted to shoot for the stars as an astronaut. Today, instead of making it to the moon, Dr. Poirier has made his mark on Earth. In 1993, at age 32, he discovered that apolipoprotein E, a protein that transports cholesterol to the brain, is also genetically linked to common Alzheimer's disease. Apo E, as it's known in scientific circles, exists in



three forms in the human body (Apo E2, 3, and 4). Dr. Poirier discovered that 80 per cent of patients who suffer from sporadic Alzheimer's, the most common form of the disease, have low levels of Apo E4. He also found out that Apo E4 partially controls the brain's communication pathways — and might regenerate some of the broken links destroyed by Alzheimer's. Dr. Poirier's discovery made the front page of *The Wall Street Journal*, and *Québec Science* proclaimed him Neuroscientist of the Year — a remarkable achievement for someone who managed only moderate grades in high school. Today, Dr. Poirier is a director and professor at the Centre for Studies in Aging, a full professor in the Department of Psychiatry, and an associate member in the Department of Medicine and Department of Neurology and Neurosurgery, all at McGill University. He believes that developing an Apo E-based regeneration treatment could help people in their 70s and 80s, the age group where sporadic Alzheimer's develops,

live out their lives in a semi-natural way. "If we delay the disease by five years," Dr. Poirier points out, "we will eliminate half the cases." Working with Nova Molecular Inc., a biogenomic pharmacogenomic firm that he founded in 1995, Dr. Poirier tests new drugs that could raise levels of Apo E in Alzheimer's patients. Achieving this goal would mean this would-be astronaut could meet his aspirations on Earth.

- She describes herself as a small-town doctor with a good sense of community values. But **Christiane Poulin**, an associate professor in the department of epidemiology and community medicine at Dalhousie University, reaches far beyond the boundaries of a small town. As an epidemiologist, Dr. Poulin's research focusses on health at the community rather



than the individual level. "I've always gravitated to issues of social inequity," Dr. Poulin says. Currently, she is receiving funding from MRC to study substance abuse among youths. The three-year study, which ends in 2001, involves four Nova Scotia schools and 2,000 students. Dr. Poulin wants to reduce involvement of harmful drugs in youths by reorienting drug education to focus on teaching young people about drug risks so that they can avoid substance abuse and determine their own futures. In

1982, Dr. Poulin graduated from l'Université Laval as a medical doctor. But she quickly found that, as a practitioner, she couldn't stop teenagers from abusing drugs. So Dr. Poulin went back to school and graduated from McGill University in 1990 with a master's degree in epidemiology. Today, she addresses drug addiction at its source and also investigates the abuse of ritalin among children. The motivation for Dr. Poulin's career change is simple. "It's difficult to fix addiction problems at the clinical level," she says.

- About 11 years ago, **Arthur Prochazka** had an idea for a glove — not just any glove, but a bionic one that would help people confined to wheelchairs or those impaired by strokes. The bionic glove would revitalize human movement for those who could no longer move. Along with his research team at the University of Alberta, Dr. Prochazka



developed the bionic glove to artificially stimulate nerve activity in the hands, so that paralysed people could open and close their hands. Starting in 1993, Dr. Prochazka spent three years constructing a prototype bionic glove in

his lab at U of A. Today, this form-fitting glove stimulates movement in a paralysed person's hand with electrodes affixed to 'motor points.' The electrodes are activated by a user-friendly stimulator/computer built into the garment. Small, voluntary movements of the wrist trigger muscle stimulation through the electrodes, which causes the hand to open or close. Clinical trials of the glove have been successful. "There are about 45 people in all who've been tested around the world," says Dr. Prochazka. The bionic glove has made appearances in Chicago, New York and Adelaide, Australia. Dr. Prochazka, a professor of physiology at U of A, is currently working on the "impact cuff", an electronic garment triggered by jarring that is used by stroke victims to retrain their paralyzed hands. "Yet another such garment reduces tremor in people with Parkinson's disease," Dr. Prochazka explains. He's also working on spinal cord regeneration through microwires. This novel research, developed with post-doctoral student Vivian Mushahwar, involves the implantation of wires directly into the spinal cord to stimulate movement. Dr. Prochazka's work holds out hope that Canadians with disabilities may some day be able to regain what they've lost.

- As a pediatrician, **Marek Rola-Pleszczynski** found himself



up against a medical brick wall. "There were so many questions that patients asked," he says, "and I had no answers." So Dr. Rola-Pleszczynski decided to pursue the answers himself. Today, he is a professor of Immunology and Pediatrics, head of Immunology in the Department of

Pediatrics, and director of the Clinical Research Centre and University Health Sciences Centre at l'Université de Sherbrooke. Dr. Rola-Pleszczynski's research is primarily concerned with inflammatory mediator receptors. These receptors are large proteins that surround the surface of cell membranes. Dr. Rola-Pleszczynski uses the analogy of a baseball mitt. The mitt is the receptor, the catcher's arm would transmit the information to the inside of the cell itself. The receptors surrounding the mitt interact with the various particles or proteins that come in contact with them and incorporate their structures into the cell. This can have positive or negative consequences for the immune system. Dr. Rola-Pleszczynski wants to understand how these receptors work, in particular receptors for lipid mediators, platelet-activating factor (PAF) LTB4 and LTD4. These powerful protein mediators could help doctors better treat people suffering from pulmonary disorders,

neurological diseases, or inflammatory bowel problems. Over the past few months, Dr. Rola-Pleszczynski has been addressing the recently cloned LTD4, a receptor that, when genetically decoded, could help people who suffer from asthma. Dr. Rola-Pleszczynski continues to work toward his goal of improving the human immune system — step by step. "It's the little developments that matter," he says.

- In the late 1970s, **Peter St. George-Hyslop** saw people



with Alzheimer's disease remain physically intact but lose their "human qualities" as their minds degenerated. Dr. St. George-Hyslop wanted to stop this loss. In 1995, along with his team of neurologists, geneticists and statisticians at the University of Toronto, Dr. St. George-Hyslop discovered

two human genes that cause the early onset of Alzheimer's disease. The genes were cloned and called presenilin 1 and 2. The discovery was an important step forward in the battle against Alzheimer's. Today, genetic testing can tell people if they will experience the early symptoms of Alzheimer's in their thirties or forties. Dr. St. George-Hyslop, who taught at Boston's Harvard University and won the Howard Hughes Foundation International Scholar Award, now wants to develop possible treatments for the

currently untreatable disease. “When you see the Alzheimer patients,” Dr. St. George-Hyslop says, “and the torment (the disease) causes to people, their families and society, it’s a strong impetus to keep going.” His current research focuses on analyzing the genetic pathways of communication in the human brain. With the help of presenilin 1 and 2, Dr. St. George-Hyslop and his research team at U of T hope to understand how these pathways are obstructed by Alzheimer’s. His research could someday help people who are losing their “human qualities” to stay whole.

- **Valerie Verge**, a McGill University graduate, first caught the research bug when she landed a job as a research technician in the laboratory of Dr. Peter Richardson, a neurosurgeon at the Montreal General Hospital who was her mentor during her doctoral studies. But it was while undertaking post-doctoral work under Professor Tomas Hökfelt at the Karolinska Institute, in Stockholm Sweden, that Dr. Verge met her future husband, a Saskatchewan farmer. That, combined with a job opportunity, brought her to Saskatchewan in 1992. Dr. Verge, now an associate professor in the Department of Anatomy and Cell Biology



at the University of Saskatchewan, is concerned with sensory neurons, or cells that affect people’s sense of touch. Neurons transmit information from the brain to various nerves and muscles. Together with her research team, Dr. Verge is investigating how the molecular profiles of these neurons change in response to disease or injury, and how we can repair them. She has discovered that a group of proteins called neurotrophins can help reverse many of the changes in these neurons following injury. Though neurotrophins may some day help people with neuropathies such as those found in diabetes, Dr. Verge is careful to add that these proteins are not the entire answer. “There’s a lot to be learned about the basic biology of nerve injury and repair, so that we can better predict their true potential,” she says. Dr. Verge attributes a lot of her research progress to the strength of her lab team at the U. of S. Although her research to date is only the first piece in a very big puzzle, she and her team will undoubtedly add more pieces as they continue their work.

- Like most great scientists, **Martin Yaffe** started out with a vision. A professor of medical biophysics at the University of Toronto and a senior scientist at Sunnybrook & Women's College Health Science Centre, Dr. Yaffe wanted to develop a machine that could detect breast tumours earlier, when treatment is more effective. In 1997, working with Don Plewes



and other scientists, he achieved his vision — digital mammography. This machine uses x-rays to photograph malignant breast tumours, but, instead of recording the picture on film, it is captured using a much more accurate electronic “detector” developed in Dr. Yaffe’s lab. Digital mammography takes X-ray photography one step further, by storing the electronic image on a computer. For the patient, it is like having a regular mammogram, but images are recorded digitally and can be magnified and enhanced with the click of a computer mouse, providing a clearer image of the breast tissues. The result is that small tumours and other early signs of cancer can be found. Three companies in the United States and one in Japan are now building digital mammography systems and one system has recently been granted FDA approval for routine clinical use in the U.S. While Dr. Yaffe believes that an important benefit of the technology comes from the

quality of the pictures, the fact the images are in digital form will make it possible to send digital images from mobile machines in remote areas to expert radiologists in larger centres who can read the mammograms. Evidence of the effectiveness of digital mammography is now being seen in clinical trials begun in 1997. One of the exciting things about the work I do, says Dr. Yaffe, “is that it involves a combination of science, engineering, and clinical testing, and lets me work with experts in all of these areas.”

- He never wanted to be a researcher. But in the late 1970s,



Salim Yusuf, then an intern in a remote Indian village 100 kilometres from Bangalore, wondered why half the patients he saw each day were suffering from gastrointestinal disease. Using a rock, a long string, and a bucket, he drew water from the village’s wells and sent the samples to a nearby laboratory

for bacterial analysis. Dr. Yusuf then rode around the village on a bicycle and bleached the wells. A subsequent test showed that bacteria levels in the village water had dropped by about 80 per cent. Dr. Yusuf had answered his own research question and had a powerful impact on the villagers’ health. This drive for knowledge led Dr. Yusuf to

a Rhodes scholarship at Oxford University, where he graduated with a D.Phil. in 1981. Since then, Dr. Yusuf's list of interests and accomplishments is impressive. His research areas include thrombolysis (the breaking down of blood clots), antithrombotics, prevention of vascular diseases, and congestive heart failure. In 1999, Dr. Yusuf discovered that a drug called ramipril reduces the risk of heart attacks by 25 per cent in high-risk patients. And this, it seems, is only the beginning for the doctor, who sees himself at being only halfway through his career. His research efforts have now extended to 55 countries, more than half of them developing countries. Dr. Yusuf says his greatest rewards come from passing on his zest for knowledge to his students at Hamilton's McMaster University, where he is director of the Division of Cardiology and professor of Medicine. "I've been fortunate to attract people who have the burning desire to change the world," he says. "It's trying to help the young people choose the big questions, and help them go after the answers." He sees in some of his students a memory of himself; a doctor who answered his driving research question with the help of a string, a rock and a bicycle.





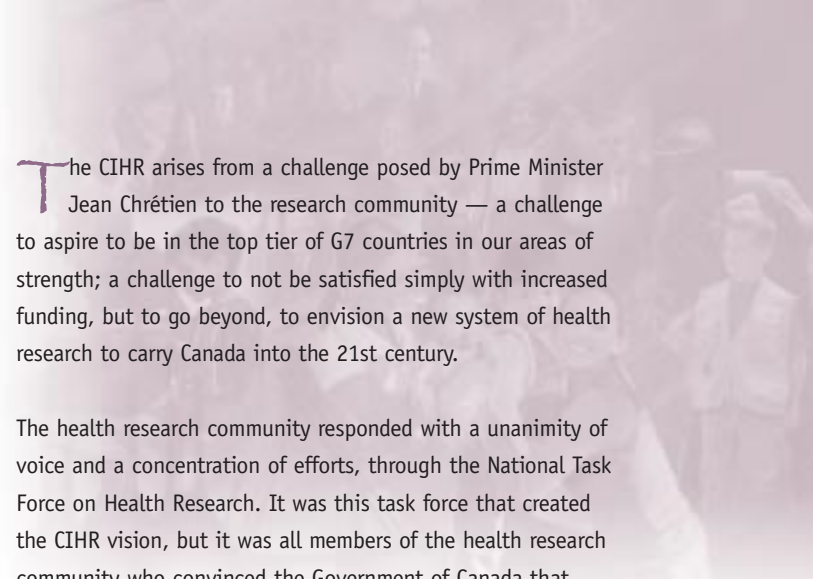


Chapter 6: CIHR — The Way Ahead

TODAY, WE STAND ON THE VERGE OF A NEW ERA IN HEALTH RESEARCH IN CANADA — AN ERA OF UNPRECEDENTED INVESTMENT IN HEALTH RESEARCH, AND AN ERA OF UNPARALLELED INTEGRATION OF DIFFERING PERSPECTIVES ON HEALTH RESEARCH. WE ARE EMBARKING UPON THE ERA OF THE CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR). THE RESULT WILL BE BETTER HEALTH FOR CANADIANS, A BETTER HEALTH CARE SYSTEM, AND INCREASED ECONOMIC GROWTH FOR CANADA.

“CIHR is a bold initiative. It has the power of a dream, of a vision. It is breathtaking in its inclusivity, in its national dimensions.”


Dr. Henry Friesen
President, MRC
Chair, Interim Governing Council, CIHR



The CIHR arises from a challenge posed by Prime Minister Jean Chrétien to the research community — a challenge to aspire to be in the top tier of G7 countries in our areas of strength; a challenge to not be satisfied simply with increased funding, but to go beyond, to envision a new system of health research to carry Canada into the 21st century.

The health research community responded with a unanimity of voice and a concentration of efforts, through the National Task Force on Health Research. It was this task force that created the CIHR vision, but it was all members of the health research community who convinced the Government of Canada that investing in this vision was the right thing to do, and that the investment would pay large dividends to the people of Canada.

CIHR is yet another example of the federal government's commitment to excellence in research. It builds on past budget measures, including the creation of the Canada Foundation for Innovation in 1997. This first step in renewing the research environment in Canada provides financial support for the modernization of research infrastructure at Canadian post-secondary educational institutions and research hospitals.



The following year (1998), the federal granting councils received an increase in their budgets of \$450 million over a three-year period.

CIHR is also complemented by the creation of the Canada Research Chairs. This new initiative will fund the creation of 1,200 new research chairs in Canadian universities over the next three years, with a further 800 chairs to be added as soon as possible. Fully a third of these chairs, or close to 700, are expected to be in health research. The program will be financed by the federal government through its granting councils, including the CIHR. Research chairs will be directed toward “star” researchers with proven track records of leading research endeavours, as well as to the “rising stars” of tomorrow.

“The federal government must be commended for putting forward a vision of an integrated health research enterprise that will benefit all Canadians. There is no better investment than in health research, where the health care dollar can be used more wisely, and where jobs can be created.”

Dr. Mark Poznansky
Council for Health Research in Canada

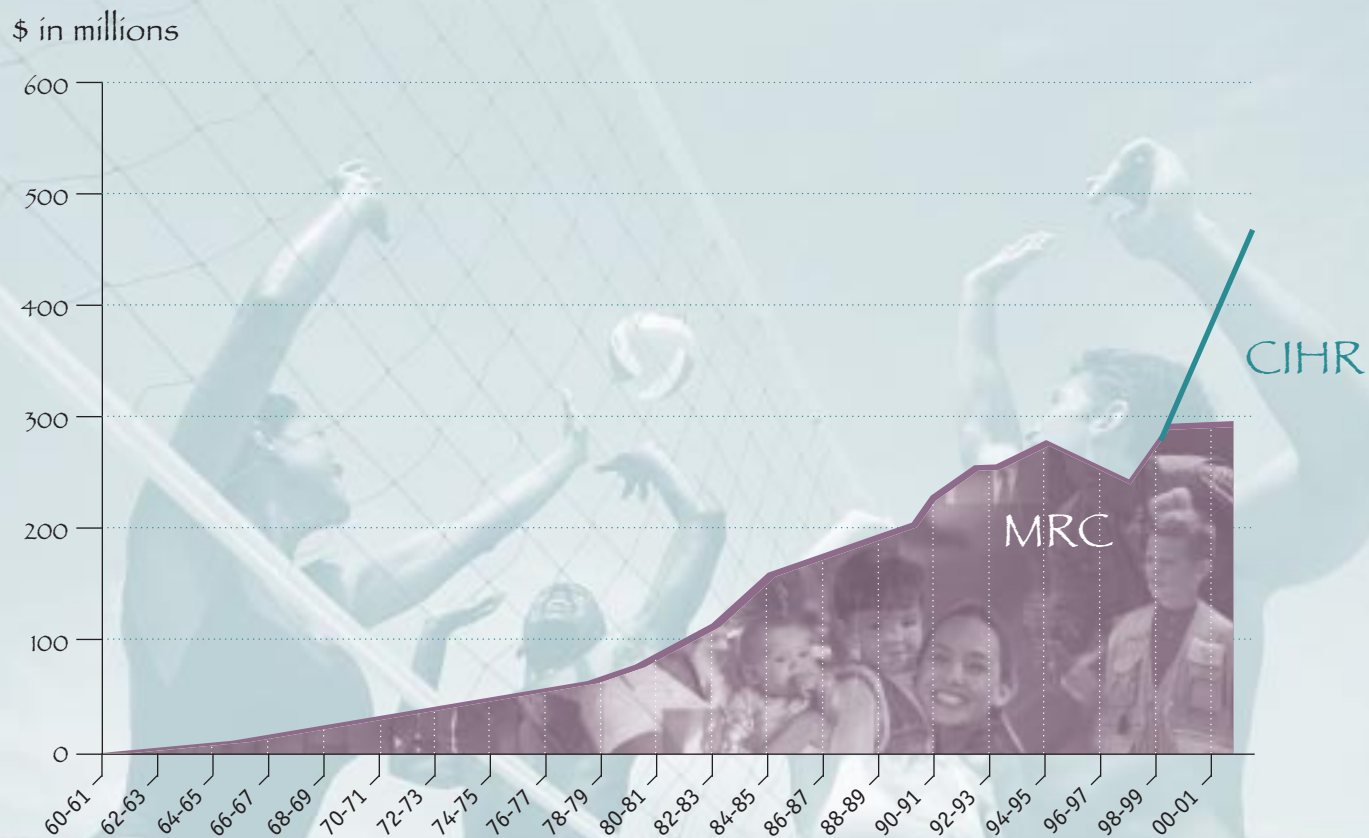
The creation of CIHR underscores the federal government’s understanding of the important role of health research in improving the health and well-being of Canadians, renewing the Canadian health care system, stimulating innovation, and training future generations. It is a natural step forward in the evolution of Canada’s health research enterprise.

“The 1999 budget may well be best remembered above all for the investment we made in modernizing Canada’s health research enterprise.”

Prime Minister Jean Chrétien

CIHR doubles the federal government investment in health research. But more than that, it represents a new approach to health research in Canada. For the first time, Canada will have a focused national health research agenda, established and supported by the federal government, in partnership with the health research community, provincial governments, the voluntary health charities, and the private sector, and responding to the health priorities of Canadians. CIHR will increase the depth, breadth, focus, utility, and interconnectedness of Canadian health research.

MRC – CIHR Budget: a 40-year history



"The objective of CIHR is to excel, according to internationally accepted standards of excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products, and a strengthened Canadian health care system."

Bill C-13, An Act to establish the Canadian Institutes of Health Research

"If we set the right objectives, if we make the right investments, if we create the right partnerships, and if we work together as a country, not only will we keep the best and the brightest in Canada, we will attract the best and the brightest from around the world to Canada."

*Prime Minister Jean Chrétien,
Response to the Speech from the Throne,
October 1999*

Canada: The place to be for excellent researchers

CIHR will have an immediate impact on the careers of Canadian scientists, creating a brain gain where once there was a brain drain. In the past few years, some of Canada's top health researchers had left for other countries, citing insufficient funding, declining success rates in MRC competitions, lack of opportunity for advancement for mid-career researchers and lack of research positions for post-doctoral students to start their careers. Since CIHR was announced, however, health researchers have been expressing new interest in Canada.

Over the past year, universities, hospitals, and research institutes have been able to attract top researchers, both those returning to Canada and those new to Canada:

- **David Park** has joined the Neuroscience Research Institute at the University of Ottawa, from Columbia University, where he held a post-doctoral fellowship.
- **Richard Frayne** has returned to the University of Calgary after a five-year absence in the United States.

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- **Pierre von der Weid** has joined the Inflammation Research Group at the University of Calgary. A Swiss citizen, Dr. von der Weid was recruited from the University of Geneva.
 - **Geoff Hicks** moved from Vanderbilt University in the United States to take up a position as an assistant professor in the Department of Biochemistry and Medical Genetics and a research associate in the Manitoba Institute of Cell Biology. Dr. Hicks has received a large MRC operating grant under the Genomics initiative, as well as a New Opportunities Award from the Canada Foundation for Innovation.
 - Sherbrooke University has recruited **Guylain Boulay** from Portland, Oregon, and **Patrick McDonald**, an MRC Centennial Fellow, from Denver, Colorado.
 - **Sachito Sato**, a researcher in infectious diseases, is now at l'Université Laval, where she is supported in her research by MRC. Dr. Sato received her doctoral degree from the University of Tokyo, and had been a post-doctoral researcher at Stanford University in the United States.
 - **Eric Brown**, a young Canadian researcher, had been working as a research scientist at the ASTRA Research Center in Cambridge, Massachusetts. He has since

returned to Canada as an assistant professor in the Department of Biochemistry at McMaster University.

- **Yingfu Li**, also a Canadian, has returned from post-doctoral work at Yale University to also become an assistant professor in the Department of Biochemistry at McMaster.
- **Jun Liu** was recruited to the University of Toronto from the Department of Molecular and Cell Biology at the University of California at Berkeley. He is currently studying drug resistance mechanisms in tuberculosis.
- **Scott Gray-Owen** was also recruited to the University of Toronto, this time from the Max Planck Institut für Biologie in Tübingen, Germany.

This new approach will bring together researchers from a variety of perspectives and with a variety of points of view to encourage multidisciplinary, integrative health research. Basic biomedical research will co-exist with applied clinical research, research into health systems and services, and population health research within thematic institutes that will take a holistic approach to health.



Throughout this transformation from MRC to CIHR, the high standards that have been the hallmark of MRC, including its world-renowned peer review process and its exemplary commitment to ethics in research, will live on in CIHR.

CIHR opens a new world for health researchers, for Canadians, and for the Canadian economy.

For health researchers, CIHR will provide the long-term commitment to support research initiatives that will leave them secure in the knowledge that they can have successful careers, with internationally competitive levels of funding, at home in Canada. Instead of brain drain, we will see a brain gain, as we build on our proud tradition of research excellence.

For Canadians, CIHR will mean the creation of knowledge that will help to prevent and treat diseases. It will mean faster development of new treatments and therapies and more efficient and cost-effective delivery of these treatments and other health services through a health care system that responds to their needs and priorities.

For the Canadian economy, CIHR will support the fast-growing life sciences sector in Canada, creating high-quality jobs for Canadians while enhancing Canada's competitiveness in the knowledge-based economy.

"The Canadian Institutes of Health Research are all about excellence. To encourage those who seek it, and to reward those who achieve it."

Health Minister Allan Rock
University of Toronto
October 22, 1999

If, as the House of Commons Standing Committee on Finance has observed, the federal granting councils are the key to Canadian leadership in the knowledge-based economy of the 21st century, then CIHR is an important step in consolidating Canada's leadership role. CIHR will allow Canada to maintain and strengthen its prominent position in the top tier of health research internationally.

The creation of the Canadian Institutes for Health Research will mean the end of the existence of the Medical Research Council of Canada. But it does not spell the end of what MRC has represented

over the past 40 years. Indeed, CIHR is a preservation and expansion of the legacy of the Medical Research Council of Canada, transforming MRC into a broader, more integrated, more visionary system of health research.

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