ESTIMATES

Medical Research Council of Canada

Performance Report

For the period ending
March 31, 1999

Canada

Improved Reporting to Parliament
Pilot Document

The Estimates of the Government of Canada are structured in several parts. Beginning with an overview of total government spending in Part I, the documents become increasingly more specific. Part II outlines spending according to departments, agencies and programs and contains the proposed wording of the conditions governing spending which Parliament will be asked to approve.

The *Report on Plans and Priorities* provides additional detail on each department and its programs primarily in terms of more strategically oriented planning and results information with a focus on outcomes.

The *Departmental Performance Report* provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the spring *Report on Plans and Priorities.*

Available in Canada through your local bookseller or by mail from

Canadian Government Publishing — PWGSC

Ottawa, Canada K1A 0S9

Catalogue No. BT31-4/46-1999
ISBN 0-660-61058-2

Foreword

On April 24, 1997, the House of Commons passed a motion dividing on a pilot basis what was known as the annual *Part III of the Estimates* document for each department or agency into two documents, a *Report on Plans and Priorities* and a *Departmental Performance Report.*

This initiative is intended to fulfil the government's commitments to improve the expenditure management information provided to Parliament. This involves sharpening the focus on results, increasing the transparency of information and modernizing its preparation.

This year, the Fall Performance Package is comprised of 82 Departmental Performance Reports and the government's report *Managing for Results* - Volumes 1 and 2.

This ***Departmental Performance Report,*** covering the period ending March 31, 1999, provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the department's pilot *Report on Plans and Priorities* for 1998-99. The key result commitments for all departments and agencies are also included in Volume 2 of *Managing for Results.*

Results-based management emphasizes specifying expected program results, developing meaningful indicators to demonstrate performance, perfecting the capacity to generate information and reporting on achievements in a balanced manner. Accounting and managing for results involve sustained work across government.

The government continues to refine and develop both managing for and reporting of results. The refinement comes from acquired experience as users make their information needs more precisely known. The performance reports and their use will continue to be monitored to make sure that they respond to Parliament's ongoing and evolving needs.

This report is accessible electronically from the Treasury Board Secretariat Internet site: http://www.tbs-sct.gc.ca/tb/key.html

Comments or questions can be directed to the TBS Internet site or to:

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MRC CRM

Medical Research Council of Canada

Performance Report

for the Period Ending March 31, 1999

Allan Rock
Minister of Health

Henry G Friesen, MD
President of the Medical Research Council

Canada

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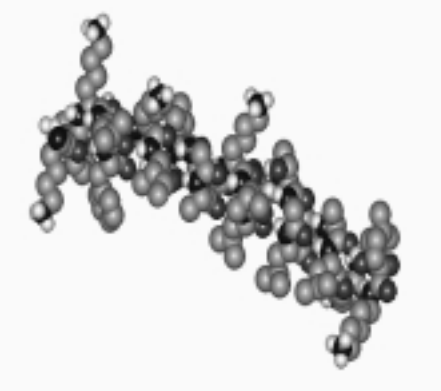


Leading-edge health research

Canadian researchers have found a protein with powerful anti-bacterial properties, an important step forward in the international search for ways to control drug-resistant strains of bacteria.

Impact on health

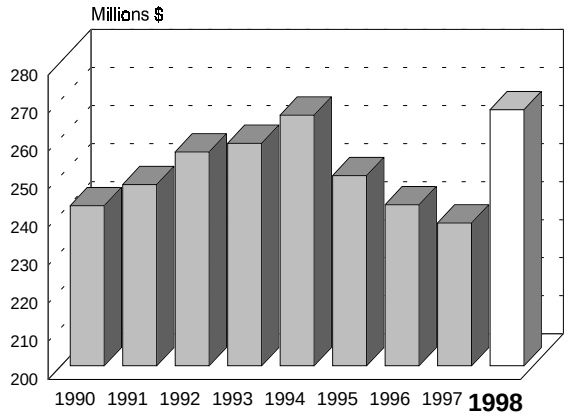
Canadian research on continuous passive motion has changed approaches to the healing of injured joints world-wide.

Executive Summary

The Medical Research Council of Canada (MRC) reports continuing strong performance in meeting its commitments to provide Canadians with:

- world-class research aimed at ensuring good health and well-being
- the social and economic benefits of health research discoveries
- a national capacity to respond to needs for research and development in all areas of health
- a national perspective on health research priorities, ethics and safety.

MRC Budgets Since 1990-91



Note: Y-axis begins at $200 million

Source: Parliamentary Main Estimates

In fiscal year 1998-99, federal funding delivered through the MRC for Canadian health science was returned to the level it had been in 1994, that is, the level prior to budget cuts required for deficit reduction. This enabled the approval of more research grants and personnel training awards than in 1997-98, and a much-needed increase in their value but did not significantly alter the gap between Canadian per capita investment in health research and that of countries such as the US or Britain. On a per capita basis, the American investment in health research is about three times that in Canada and the per capita investment in the United Kingdom is double our own.

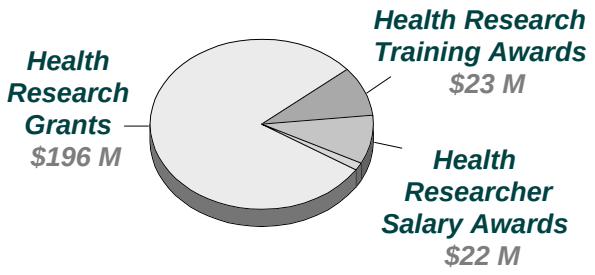
Health research is an investment in the future, a long-term undertaking that requires the training and development of skilled, innovative researchers and the maintaining of a physical infrastructure of facilities and equipment. It requires the patient awaiting of results, knowing that any one project may provide but a small link in a long chain of discoveries that will eventually yield a result of enormous import to health. This report indicates the extent and quality of the research that Canadians support through the MRC and offers a sense of the promise offered by excellent research. It also presents stories about the impacts

of past research to illustrate the exceptional returns that a research investment can yield.

Fiscal year 1998-99 marks a clear transition point in Canada's health research enterprise. Determined to do something about the chronic under-funding of health research in this country, and to address the need for greater coordination among research funders, performers and consumers, the MRC helped assemble a coalition of stakeholders to develop a national framework for an expanded health research enterprise. The outcome was a proposal to government for the creation of a national structure, Canadian Institutes of Health Research, that would provide a vehicle for an increased public investment in health research and a drawing together of diverse stakeholders around health research themes, thus facilitating the development of shared research priorities.

Investing in Health Research for Canadians

Research resources delivered across Canada by the Medical Research Council



Estimated number of people Involved in MRC-supported research across Canada

Researchers	*3,336*
Technical assistants	*1,900*
Postdoctoral fellows	*815*
Graduate students	*2,228*
Undergraduate students	*1,283*

Federal budget announcements in February 1999 included the most welcome news that government will proceed with the establishment of Canadian Institutes of Health Research (CIHR) and will provide more than $500 million over fiscal years 1999-2000, 2000-01 and 2001-02 to transform the concept to reality. It is expected that by April 2000, the MRC will be fully integrated in CIHR and, that by year 2001-02, the federal investment in extramural health research will be more than double the amount it was in 1997-98. CIHR will transform the Canadian health research enterprise, improving the rate, depth and focus of our research efforts and creating an environment that will help Canada retain its best scientists and provide inspiration for our young. The MRC is pleased to report to Parliament, as its single most important achievement of 1998-99, the successful bringing together of minds that led to the announcement of Canadian Institutes of Health Research.

I PRESIDENT'S MESSAGE

It is a pleasure to once again report to Parliament on the performance of Canadians' investment in health research through the Medical Research Council program. The $246 million of public funding delivered through MRC grants and scholarships in 1998-99, complemented by the $14 million for Networks of Centres of Excellence in health research, enabled the continuation of outstanding studies and the initiation of exciting new lines of investigation across the entire spectrum of health issues, from the examination of living processes at the molecular level to studies of health-related behaviours in Canadian communities. Federal funding supported the work of over 3,300 Canadian health scientists in universities, hospitals and research centres across the country and in so doing provided over 6,200 employment and training opportunities for research assistants, students and postdoctoral fellows.

Henry Friesen
OC, MD, FRCPC, FRSC

Health research is often a venture into uncharted territories, a long-term enterprise from which the impacts on health maintenance and medical treatments may not appear until many years later and often from lines of work that at the time may have seemed far removed from any practical outcome. Reporting the health and economic impacts of research in progress thus presents quite a challenge. While econometric studies consistently confirm that, over the long-term, the benefits generated by a broad portfolio of health research projects will exceed the cost of resources invested, it is virtually impossible to know in advance which of the projects now underway will yield those benefits.

Governments around the world are deeply interested in the challenge of assessing research performance. In the United States, for example, members of the House of Representatives asked the National Academy of Sciences to conduct a comprehensive study on the reporting of research performance through the Government Performance and Results Act. The NAS study found that for applied research it is appropriate to set performance goals against which progress may be

On assessing research performance

Governments around the world are deeply interested in the challenge of assessing research performance. In the United States, for example, members of the House of Representatives asked the National Academy of Sciences to conduct a comprehensive study on the reporting of research performance through the Government Performance and Results Act.

Results of the study appear in *Evaluating Federal Research Programs*. 1999. National Academy Press. Washington DC.

assessed. But for research on fundamental questions, the setting of targets, such as publication of a given number of research reports, is inadvisable and even counterproductive. When reporting performance on such programs, the NAS study recommends that agencies provide indicators of the quality and relevance of the research they support and an assessment of the importance of that research to the advancement of world knowledge. These indicators of work in progress should be accompanied by evidence of impacts from work supported in the past. Generally speaking, we follow such an approach in this year's report on the MRC program.

Reporting on the performance of a research investment is one thing; reporting on the adequacy of that investment is another. For many years, the Medical Research Council, researchers, committees of government (such as the National Advisory Board on Science and Technology) and other organizations, have in different ways been making the point that federal funding for health research was about one third what it should be if we want to maintain a strong national competency for research to address health threats, ensure an effective care system and realize the commercial spin-offs from world advances in health knowledge. It is thus a very special privilege this year to be able to thank Parliament on behalf of all Canadians for its enthusiastic reception of the February 1999 announcement of plans for Canadian Institutes of Health Research and a very significant increase in public funding of the search for new knowledge.

A warm and resounding *thank you . . .*

It is a very special privilege this year to be able to thank Parliament on behalf of all Canadians for its enthusiastic reception of the February 1999 announcement of plans for Canadian Institutes of Health Research and a very significant increase in public funding of the search for new knowledge. This bold, nation-building initiative will transform our country's health research effort.

This bold federal initiative will transform our country's health research effort. Canadian Institutes of Health Research is a truly nation-building endeavour that will draw Canadians together around health research themes of special concern, reaching across provinces, across research disciplines, across institutions and across sectors. By providing greater structure and funding for the Canadian health research enterprise, we will create an environment that will enable us to conserve and build intellectual capital, to keep our best scientists here and to inspire young Canadians to join in the unending process of discovery. We can look forward to rapid, strong growth in our capacity to contribute to the pool of world knowledge and to draw from it ideas that we can put to use to improve quality of life for all.

II AGENCY OVERVIEW

Mandate

- **To promote, assist and undertake basic, applied and clinical research in Canada in the health sciences.**
- To advise the Minister of Health in respect of matters relating to such research [...]
- To expend any money appropriated by Parliament for the work of the Council or received by the Council through the conduct of its operations; and, to publish and sell or otherwise distribute such scholarly, scientific and technical information relating to the work of the Council as the Council considers necessary.

Mission

To build and sustain, in partnership with others, a national capacity to create and use new knowledge for maintaining and improving health and preventing, curing and treating illness, for the social and economic benefit of Canadians and the well-being of people everywhere.

Vision

An internationally-competitive Canadian health research community generating new knowledge that contributes to improvements in quality of life and supports the growth and expansion of Canadian industry in the health area.

MRC CRM

Operating Environment

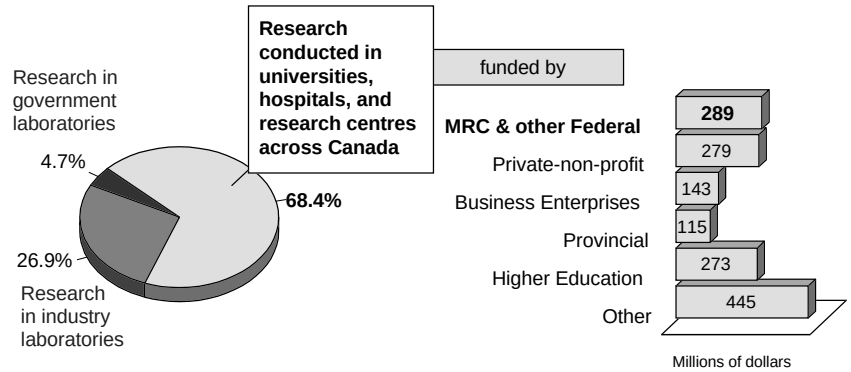
Objectives of the MRC	▫ provide a **knowledge base for continuing innovation** in health services, health maintenance, diagnosis and treatment of illness ▫ **focus a national research effort** on health threats and opportunities ▫ facilitate the return of the **social and economic benefits** of health research to Canadians ▫ **diversify and strengthen Canadian health research** through partnered funding ▫ **train and develop Canadian scientists** with a capacity to address research questions in all areas of health ▫ provide a **national voice** on health research issues
MRC Strategic Priorities	*enlarge the scope of MRC activities, committing to **a greater range of health science research*** *pursue **excellence and innovation** in the areas of basic and applied health research* ***demonstrate value**, the efficient use of scarce resources and accountability in all activities* Investing in Health Associé à la vie MRC CRM Medical Research Council of Canada / Conseil de recherches médicales du Canada

Canadian Health Research Funding

Health research in Canada is a partnered enterprise involving a wide variety of research funders, performers and consumers. Researchers in federal government facilities conduct a relatively small proportion of Canada's health research (about 5%), primarily focussed on ensuring the quality of our foods, drugs, air and water. Health-related firms, particularly in the pharmaceuticals industry, conduct about 27% of the country's health research. **The majority of Canada's health research (68%) takes place in universities, hospitals and research centres across the country.**

The federal government provides the largest contribution of resources to academic research. Through the MRC, government supports a platform of academic research in all areas of health, thus ensuring a national capability to address health questions of all kinds. Other funders invest in academic research according to their special interests. Health charities focus their support on research related to specific health problems; firms invest in university health research relevant to their business. Provinces also fund academic research, both to build capacity for innovation and to answer specific questions related to their health care responsibilities. Universities and other institutions of higher education contribute very significantly to the national effort, primarily by providing university professors with time for research and facilities in which to pursue their work.

Sector and Funding of Health Research



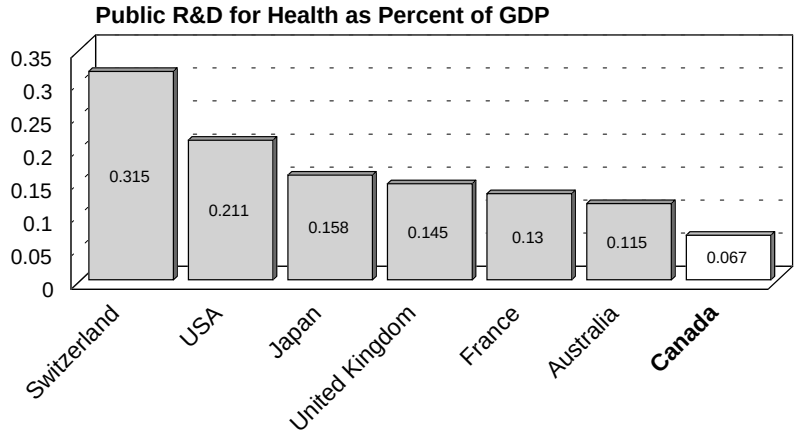
Source: Statistics Canada, Science Statistics, V3 n4. 1998 data

Challenges

The people of Canada face two major challenges in building and maintaining a national capacity to respond to threats and opportunities in the health area through research. The first is to assemble the resources necessary for a research enterprise that can perform effectively on the world stage, contributing to the advancement of health knowledge and absorbing new knowledge for innovation in health care delivery, health maintenance and treatment of illness. The second challenge is to coordinate the delivery of those research resources as effectively as possible in a complex environment in which multiple funders and research performers are spread across a vast country and a wide range of interests and priorities.

In announcing funding for the creation of Canadian Institutes of Health Research (CIHR), the federal government has taken a giant step forward towards meeting those two challenges. Through CIHR, public funding for health research in universities, hospitals and research centres across Canada will more than double between 1997-98 and 2001-2002. This determined expansion of research resources, building on current federal investments through the granting Councils and the Canada Foundation for Innovation, will allow our health researchers to increase the breadth and rate of their studies. It will allow the support of more students and fellows, thus building future research capacity. Canadian Institutes of Health Research will transform the Canadian research landscape.

Investment in Health R&D Around the World



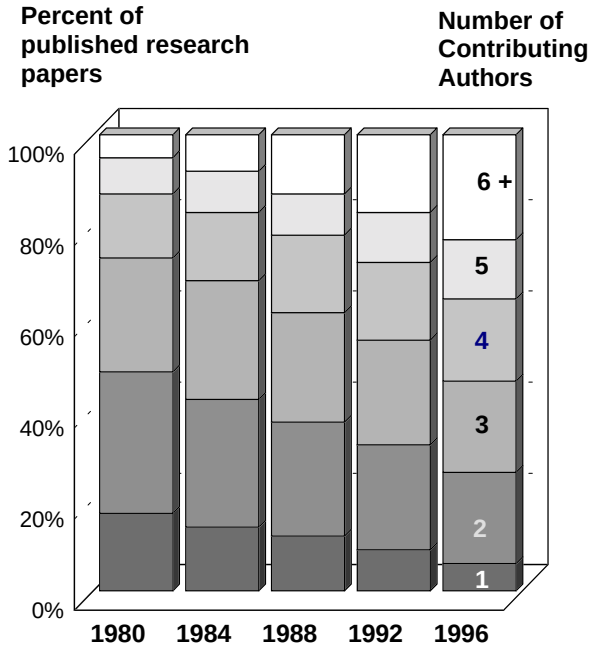
Source: OECD Health Data, 1998 (1995 data), from Commonwealth of Australia, Health and Medical Research Strategic Review, The Virtuous Cycle, 1998/9, Exhibit 5.0 - 4

But it would be unwise to imagine that the funding challenge has been met. Canadian health research, though recognized worldwide as scientifically important, has been underfunded for so long that a doubling of the federal contribution takes us only part of the way along the road to full research capability. The per capita investment in health research in other countries clearly outdistances our own. In the United Kingdom, per capita funding for health research is about double that in Canada; and, per capita, US citizens invest three times the amount of Canadians. Attaining an internationally comparable investment in health research remains a major challenge.

The realization of Canadian Institutes of Health Research will also begin to address our second major challenge, ensuring that delivery of national research resources is coordinated to maximize effectiveness. By drawing together health interest groups, researchers, health professionals and research funding organizations around health themes of common concern, Institutes will provide a forum from which national research priorities will emerge. Clarity of research goals and priorities is critical to efficiency in the allocation of research resources.

Health research is increasingly a collaborative research activity, requiring interaction of researchers from different disciplines, sectors, countries and cultures. Teamwork at all levels of organization - local, regional, provincial, national and international - brings a broad range of perspectives to bear on complex health problems whose resolution requires a full understanding of the underlying and interacting social, economic and biological forces. Canadian Institutes of Health Research will foster the development of linkages among researchers whose work addresses different aspects of a given health question. Research by multi-investigator groups is neither straightforward nor easy, and requires that each participant spend much time and effort learning to appreciate each the perspectives of others. But it is through such work that we will be prepared to address the challenges to our health care system arising from changing demographics, environmental hazards and nature's capacity to rapidly render obsolete our strategies for preventing illness.

Health Research is Increasingly a Collaborative Activity



Source: L'Observatoire des s&t, from slide show, Presentation for S&R, 1998.

Canadian Institutes of Health Research will help ensure that the growth of research collaboration observed in the 1980s and 90s will continue as the next millennium begins

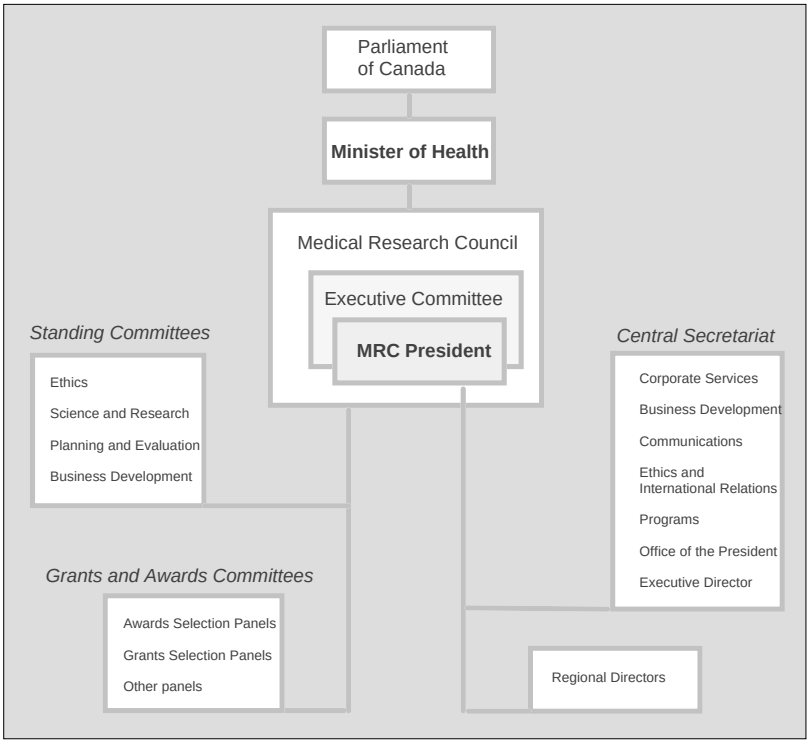
In 1996**, 36% of research papers had five or more authors**.
In 1980 it was 13%.

In 1996, **67% of papers involved more than one research institution**.
In 1980 it was 44%.

In 1996, **30% of papers involved international collaboration.**
In 1980 it was 12%.

Organization of the Agency

The Medical Research Council is governed by a board of eminent Canadians appointed by Order in Council and serving without remuneration. The Council provides government with advice on how it can best promote, assist and support research for the benefit of Canadians and the improvement of quality of life for all. Members bring to the Council table their wisdom and expertise in matters of science, health, administration, business and ethics. As an arms-length agency of government, the Council reports to Parliament through the Minister of Health.



Delivery of the Council's program is supported by a Secretariat of 85 persons based in the National Capital Region. A network of volunteer Regional Directors in health science centres across the country provides the Council with a channel for communication with stakeholders from sea to sea.

The Council receives advice on policy, priorities, strategies and development from Standing Committees comprised of experts drawn from the health research community and other groups of Canadians with special expertise and a strong commitment to health research.

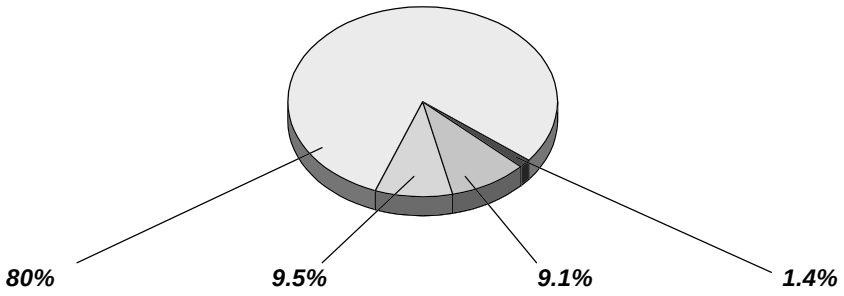
Advice on the quality of research proposals submitted to the MRC, or advice on the merits of proposals for the training and development of research personnel, is provided by panels of specialists. These grants and awards selection committees involve over 550 Canadians who offer their expertise freely to help MRC ensure that public resources for health research are invested in the most promising projects and training programs.

III AGENCY PERFORMANCE

1998-1999 Financial Data for the Medical Research Council of Canada		
Planned Spending	$267, 278, 700	as in 1998-99 Main Estimates
Total Authorities	*$271, 499, 024*	*as in 1998-99 Public Accounts*
Actual Spending	**$271, 367, 124**	**as in 1998-99 Public Accounts**

MRC Program Expenditures at a Glance

(Does not include NCE or Administrative Expenditures)



Health Research Grants	Research Training Awards	Researcher Salary Awards	Other Research Support
$ 196.4 M	*$ 23.4 M*	*$ 22.2 M*	*$ 3.6 M*

Operating	148.6	Fellowships	10.0	Scholarships	9.0	Gen. research	1.6
Groups	23.9	Grad Students	9.2	Scientists	4.5	Other Organiz.	1.2
Targeted	6.1	Challenge Fund	1.7	Snr. Scientists+	2.6	President's Fund	0.5
U-I grants	5.3	Clinician Sci. I	1.0	Development	1.6	Travel/Exchange	0.3
Clinical Trials	4.5	U-I training	0.9	Groups	1.6		
Maintenance	3.3	Undergrad	0.5	Clinician Sci. II	1.2		
Special Projects	2.3			U-I salaries	1.0		
Equipment	2.3			Other	0.6		

Source:
Schedule 4
CIHR/Research Funding in the Health Sciences, July 1999

The Medical Research Council of Canada is committed to providing Canadians		
with . . .	***as demonstrated by . . .***	***as reported on pages . .***
world-class research aimed at ensuring good health and well being	international calibre research projects in institutions across Canada on fundamental processes underlying health and illness, prevention and treatment of disease, and health services	15 to 20
	special research initiatives on health issues of particular concern to Canadians such as breast cancer, diabetes and AIDS	21 to 23
the social and economic benefits of health research discoveries	research results having an impact on illness prevention, identification and treatment of disease, or health services	24 to 26
	commercialization of health research discoveries with resultant creation of jobs and economic opportunity	27 and 28
a capacity to respond to needs for research and development in all areas related to health	trained and experienced researchers capable of responding to knowledge requirements in all health areas	29 and 30
	research resources and capacity generated by partnerships between MRC and other organizations	31 to 34
a national perspective on questions of health research priorities, ethics and safety	advice and guidance on research priorities, ethics and safety	35 and 36

Performance Expectations

The MRC believes that the people of Canada expect it to provide good advice to government concerning the national need for public investment in health research. Managing the resources that government is prepared to invest, and working in partnership with other funders of health research, MRC is expected to support programs and projects that best serve the needs of Canadians.

We believe that Canadians expect health research funding to be delivered fairly, on the basis of the excellence of proposals and the need for new knowledge that research could provide. The research portfolio as a whole must must deliver results that have a positive impact on health and the economy. Funding should be delivered with an eye to the future, ensuring that Canada is replenishing its research capacity by supporting the training and development of Canadians who have both a desire to help improve health through research and an ability that allows them to place among the best researchers around the world. And we believe Canadians expect that the research funded by government through MRC adhere to high ethical standards and be conducted with extreme care for the safety of all.

On Attributing Responsibility for Research Results

The research conducted by a scientist or group of scientists is enabled by an infrastructure which has provided them with the necessary education and training, facilitated their development as knowledge workers, given them time to think and work, and made available the research space and equipment they require. Less obviously perhaps, their research is enabled by a knowledge infrastructure created by the millions of men and women who have contributed to the understanding of nature and societies over many hundreds of years. It would be inappropriate to attribute the results of all these interacting variables to a particular grant provided by a particular agency.

Value for Money

The Return on Investment in Research

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. Those specializing in R&D assessment agree that private investment in R&D provides an average 20 to 30% annual rate of return and a much greater return to society overall. Social rates of return from research average about 50%.

What other investment can provide an annual rate of return of up to 50%?

Source: National Science Foundation, Science and Engineering Indicators, 1996. Chapter 8. Economic and Social Significance of Scientific and Engineering Research.

The federal investment in health research may be viewed as an essential contribution to a reservoir whose waters drive a Canadian generating station that produces not electric power but new knowledge and innovation. The reservoir is also fed by charitable organizations to which the public has donated funds for research, by provincial governments and by industry with profits made from consumer sales. When the system generates a particularly exciting insight about maintaining health, or a new method for preventing a troublesome illness, or a powerful new medicine with important economic potential, it is not useful to try to identify which contributor to the reservoir was responsible. To do so would be like trying to identify the source of the water that was flowing through a turbine at the particular moment of a surge in power. When the system produces, all contributors to the system deserve credit.

Thus in this report we refer to both Canadian health research and MRC-supported research, adopting the broad, integrated view of health innovation that gave rise to the idea of Canadian Institutes of Health Research.

The federal investment in health research may be viewed as an essential contribution to a reservoir whose potential drives the turbines of our system of health innovation.

Performance Accomplishments

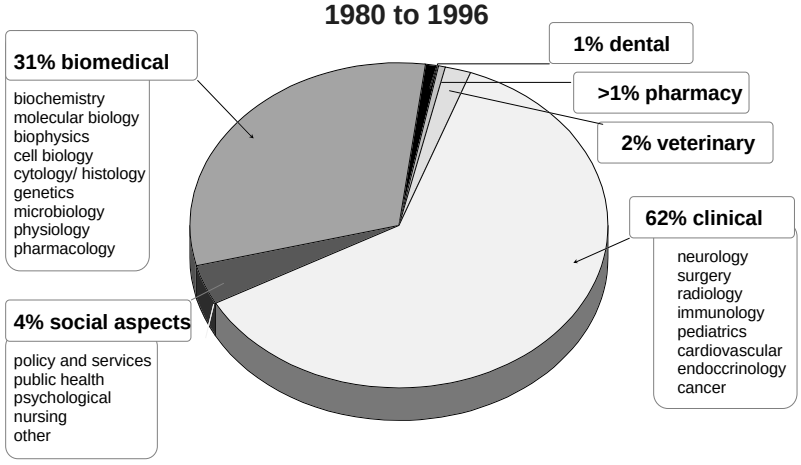
Performance of the MRC program will be presented under seven headings, reflecting the areas listed in our chart of commitments to Canadians:

1. world-class health research
2. research on priority health issues
3. Improving health through research
4. commercial spin-offs
5. training and developing researchers
6. research funding partnerships
7. national perspective on research issues

1) World-Class Health Research

The quality of Canadian health research will be reported from three perspectives. First, our health science will be measured against international benchmarks. Then we will describe the MRC's highly demanding review of proposals which ensures that funds flow to outstanding researchers. Finally, examples of projects will be presented to illustrate the quality and potential of Canadian health science.

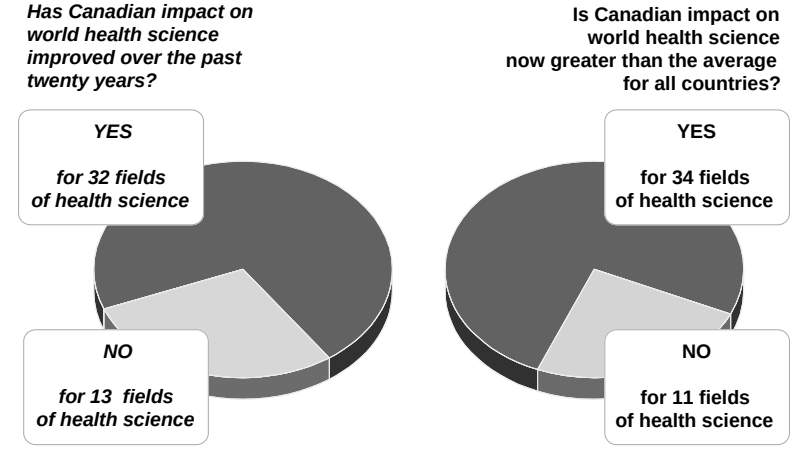
Canadian Production of Health Knowledge



Source: L'Observatoire, from S&R slide show

International comparisons of health research are often based on the number and scientific importance of health science articles published by a country's researchers. The Institute for Scientific Information in the United States has specialized in tracking scientific publications around the world and recording the number of times that each paper is cited by other researchers. These counts of citations by other scientists is considered a useful indicator of the impact of research publications on world science.

Impact on World Health Science



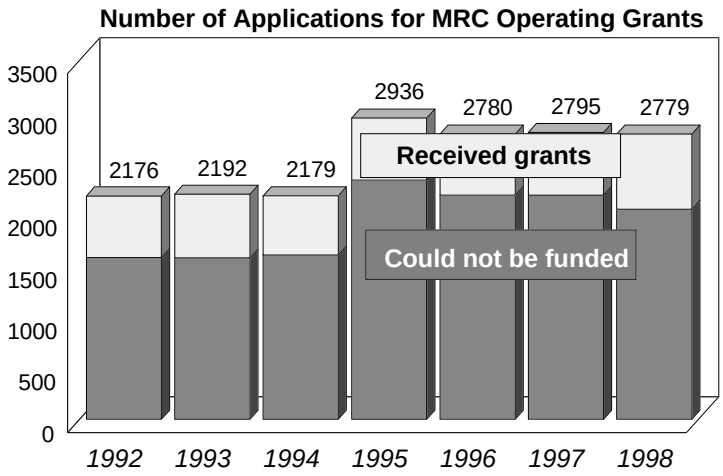
Source: National Science Indicators, ISI

Using data from the Institute for Scientific Information, we examined the impact of Canadian work in 45 areas of health research relative to work by researchers in other countries. Data were compiled for two time periods, 1983 to 1987 and 1993 to 1997. For 32 fields (71%), the world impact of Canadian science had improved, a positive indicator of growing research strength in which Canadians may take pride. For the majority of fields (34 fields of health science, or 76% of the subject areas), the global impact of Canadian health science is now above the world average. Through initiatives such as the CIHR, Canadians will be able not only to maintain the research strengths that they have built up over the years but also to strengthen

capacity in those areas in which impact is below the world average. It is worth noting that our researchers are among the most efficient in the world, producing an outstandingly high number of publications relative to the funds available.

Potential for Greater Investment

To appreciate the quality of health science projects supported by the Medical Research Council it is helpful to understand the process through which applications for funding are screened, rated and put in order of priority for the funding available. The typical proposal for a research grant is the product of several months of work by the applicants. They will have studied the literature related to their research idea, focussing on questions that remain unanswered. In the grant application they will explain their hypothesis, its scientific and practical importance, and the methods that they will use to seek the answers to questions. A detailed budget will explain how grant funds will be used to hire research technicians and student assistants and buy research equipment and supplies.



Source: CIHR, Research Funding in the Health Sciences, Chart 2

Not surprisingly, the vast majority of proposals describe important work that should proceed. The MRC must select from this pool of promising research ideas a relatively small proportion for which funds are available. Each application is sent to research experts in Canada or around the world for a written assessment of strengths and weaknesses. Then, applications are sent to panels of researchers with expertise in the same general area as the proposal. Panellists carefully examine the qualifications of the applicants and their past research efforts and achievements. Taking into consideration the written reviews provided by other researchers, the panel assesses the originality of the proposal, its likely impact and its feasibility.

***The Nobel Prize** . . .*

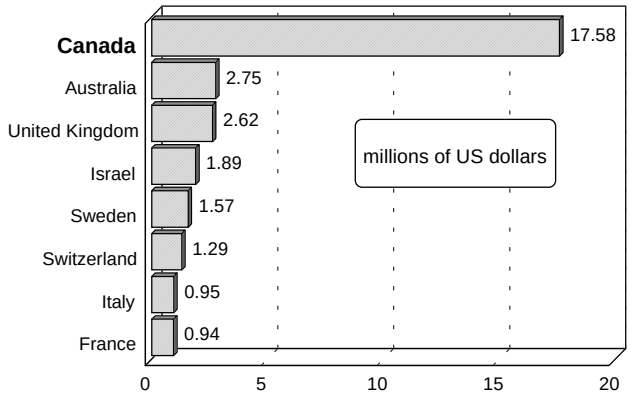
Canadians may be proud of having supported **Michael Smith** as an MRC Career Investigator. He shares a Nobel Prize for developing a research technique, known as site-directed mutagenesis, which enabled rapid advances in laboratories around the world on understanding the molecular basis of health and disease.

. . . a powerful Indicator of world-class research

Panels rate the applications on a scale of 1 to 5 in which any application rated 3.0 or higher is considered a good investment of public funds and clearly supportable. In recent years, shortage of funds has required the MRC to turn away many hundreds of projects that panels had clearly identified as solid and significant research that should be funded. It is difficult when a researcher whose scientifically sound project could not be funded must tell his or her graduate students, research technicians and postdoctoral fellows that they must begin looking elsewhere for work.

Canadian Health Research is Highly Valued in the U.S.

Top eight recipients of international grants from the U.S. National Institutes of Health



Source: NIH web site, from Commonwealth of Australia, Health and Medical Research Strategic Review, The Virtuous Cycle, 1998/9, Exhibit 5.0 - 10

International prizes and awards for Canadian health science indicate its quality as perceived by the rest of the world. Our health researchers, like most Canadians, tend to be modest about international recognition, but their research is very highly valued. A text box on the preceding page describes the Nobel prizewinning work of Dr. Michael Smith and on the next page, we provide information on 18 Canadian winners of prestigious International Scholarships from the Howard Hughes Medical Institute. All 18 have received substantial support and recognition from the MRC.

In 1998-99 the MRC funded over 3,000 research projects through a variety of mechanisms ranging from individual research grants to networks of centres of research excellence. These projects covered the full spectrum of health questions, from those that probe the structure of molecules to those that ask about the relationship between community behaviours and health. It is through stories of individual projects that Canadians can really begin to get a sense of the quality of the work that they support through the MRC. We will present some in the pages that follow.

International Excellence in Canadian Health Research

Between 1980 and 1996:

- Canadian health scientists increased their share of papers in the world health research literature
- the growth in their publication activity exceeded the G-7 average
- the number of Canadian articles in the world's foremost health research journals almost doubled
- patents resulting from health research discoveries increased almost 20-fold

Source: L'Observatoire des sciences et des technologies

World-Class Canadian Health Research

Canadian Winners of International Scholarships from the Howard Hughes Medical Institute

Name	*City*	*Research*
Vanessa Jane Auld	**Vancouver**	Role of genes in development of the nervous system
R. Chris Bleackley	**Edmonton**	Activation and inhibition of the apoptotic pathway
B. Brett Finlay	**Vancouver**	Intracellular survival of Salmonella
Jack Greenblat	**Toronto**	Regulation of transcription by an RNA polymerase
Sergio Grinstein	**Toronto**	pH of the Golgi complex and oncogenic activity

Federal Support for Research Excellence

All 18 of these winners of International Scholarships have received research grant support from MRC and are training MRC research fellows or students. Sixteen have received salary support from MRC to enable a full-time commitment to health research.

Philippe Gros	**Montreal**	Intracell iron transport
Mitsuhiko Ikura	**Toronto**	Protein mimicry of DNA in transcription
Lewis E. Kay	**Toronto**	Future of Nuclear Magnetic Resonance
Robert G. Korneluk	**Ottawa**	Apoptosis: genetically programmed cell death
Roderick R. Mcinnes	**Toronto**	Causes of retinal degeneration
Tim Mosmann	**Edmonton**	Regulation of T cell immune responses
Michael A. Parniak	**Montreal**	Preventing HIV transmission
Richard Rachubinski	**Edmonton**	Reconstitution of peroxisomes in vitro
Janet Rossant	**Toronto**	Fibroblast growth factor: embryonic development
Nahum Sonenberg	**Montreal**	Cell growth and proliferation control
Peter St. George-Hyslop	**Toronto**	Gene mutation and Alzheimer's disease.
Lap-Chee Tsui	**Toronto**	Molecular genetics of a major developmental syndrome
James Robert Woodgett	**Toronto**	Genetic analysis of cell survival

International Calibre Health Research

Progress in the Search for More Effective Antibiotics

The health challenge:

Many types of bacteria are becoming resistant to available antibiotics. Because bacteria can replicate as often as once every 20 minutes, and exhibit a remarkable ability to change their physical and chemical makeup, antibiotic-resistant strains can rapidly evolve. Until recently, we humans have been able to deal with these new strains of bacteria by producing altered versions of existing families of drugs such as the penicillins and tetracyclines. But increasingly this strategy is proving inadequate against bacteria now known familiarly as "superbugs".

One of these highly virulent strains of bacteria known as "methicillin-resistant *Staphylococcus aureus"* (MRSA) has defences against all but one antibiotic, vancomycin. MRSA can cause serious, often fatal, infections in lungs, skin, wounds and blood and there is a concern that it may soon develop resistance to vancomycin by incorporating genes from a strain of enterococcus that is already invulnerable to every antibiotic on the market. The increase in numbers of Canadians infected by MRSA is so rapid as to be considered an epidemic. In Ontario, for example, the number of cases of infection have risen from about 500 in 1992 to 8,000 in 1998.

Methicillin-resistance *S. epidermidis* (MRSE) is a bacteria found primarily on skin tissue. This organism was once considered a non-threatening contaminant. Now, it has been established as a leading cause of hospital-acquired bloodstream infections. More than 80% of *S. epidermidis* isolates in U.S. hospitals are resistant to methicillin, as well as vancomycin, otherwise known as the antibiotic of last resort. It is a growing concern, particularly for cancer patients with weak immune systems.

In North America alone, more than 2 million patients acquire infections each year as a result of being hospitalized, with at least 60% of these infections caused by drug-resistant bacteria. Multi-drug-resistant bacteria are estimated to cause the deaths of 60,000 to 80,000 people annually in the United States. The direct cost of treating these infections is about $30 billion per year.

Help from Canadian health research:

Bob Hancock at the University of British Columbia is an MRC Distinguished Scientist, a participant researcher in the MRC-PMAC Health Program, and a member of the Canadian Network of Centres of Excellence in bacterial diseases (CBDN). His work on new antibiotics involves close collaboration with researchers in universities and firms across Canada and around the world. They are focussing on molecules known as "cationic peptides" which are produced by virtually all organisms, plant and animal alike, as part of their defence against infection. **Cationic peptides act rapidly against all types of bacteria,**

Cationic peptide structure

including the troublesome, antibiotic-resistant superbugs. Work led by Dr. Hancock has generated significant findings:

- The cationic peptides destroy bacteria by binding on their surface, quickly prying open holes in their outer membrane then attacking their cytoplasmic membranes. This swift, physical assault is quite different from the action of conventional antibiotics which interfere with the biochemical mechanisms of bacteria. Drug-resistant bacteria are efficiently disabled.

- Bacteria have great difficulty developing resistance to the physical action of cationic peptides.

- Cationic peptides can be used independently or in synergy with other antibiotics to produce very large increases in antimicrobial effect.

- They can be obtained quite inexpensively using microorganisms whose genes have been modified so that they produce the peptides.

Impact on the next generation of researchers

Many young researchers have worked alongside Dr. Hancock in the research on cationic peptides. The project provided positions for five doctoral students and eight post-doctoral fellows, several of whom have continued to work in the area of bacterial control both in universities and firms. The project has been a source of inspiration for pre-university students involved in science projects or working as volunteers in the lab. It has also provided full-time employment for two laboratory technicians.

Health innovation

Development and testing of this new approach to control of harmful bacteria will take time and it will likely be five years or more before it enters general use, but when it does, the impact will be felt around the world. Meanwhile, Micrologix Biotech, a Vancouver-based company, has licensed the biotechnology for producing cationic peptides. Micrologix is currently testing cationic peptides for treating acute acne and preventing infections from catheterization. As a result of its involvement with cationic peptides, Micrologix has grown from one to over 40 employees, has raised $30 million in capital and now has its stock traded in public markets.

In April 1999, Micrologix Biotech announced the successful completion of a preliminary clinical trial of MBI 226 (Bactolysins), its lead antibiotic peptide for preventing bloodstream infections in patients undergoing central venous catheterization. The study showed that MBI226 is safe and well tolerated, eliminates 99.9% of bacteria commonly found on the skin and prevents bacterial growth on catheters. Micrologix plans to begin Phase II clinical trials later this year.

Communicating research results

The research has led to over 20 articles in international journals such as *The Lancet* and *Gene* and stories in a variety of various newspapers and magazines. The CBC television program "Prime Time" has aired a 30 minute segment featuring Dr. Hancock's work on antibiotic resistance and the potential of cationic peptides.

2) Focussing Research on Health Priorities

In partnership with other organizations, MRC is helping to focus research on health issues that have been identified as special threats to the health of Canadians (e.g., AIDS, breast cancer and diabetes). In 1998-99, MRC and partners earmarked over $18 million for research in those areas. It is important to recognize, however, that such funding represents only a small portion of the investment in research that is relevant to these health problems. Much of the research on basic mechanisms of human biology or health behaviours addresses fundamental questions whose answers will increase understanding of many illnesses.

Council is also working with partners to promote special initiatives in research areas that offer exceptional potential for improving the health of future generations. A Genome research program is helping ensure that Canada participates more fully in the international effort to map the human genome (the template of human genes). This fifteen year study, which commenced in the late 1980s, is the biggest single biology project ever undertaken. The knowledge of human genetics enabled by a complete map of the genome will transform our approaches to health maintenance. Having Canadian researchers involved in the determination of genetic sequences and in studies of the social and ethical issues that surround increased knowledge of genetics, helps prepare us to benefit from wise and effective use of resultant new health knowledge and technologies.

The MRC plans to deliver approximately $33 million for HIV-AIDS research over the period 1998 to 2003, using both its direct allocation from Parliament and additional research funding from the Canadian Strategy on HIV-AIDS. On the following page, a text box indicates important Canadian contributions to the world effort to better understand the virus and the syndrome that it precipitates. A table provides a quantitative overview of the investment in HIV-AIDS research delivered through the MRC in 1998-99.

Breast Cancer: Improved diagnostic capability resulting from Canadian health research

Approximately one in nine Canadian women will develop breast cancer at some time. Early detection allows early treatment, which can mean stopping cancer before it spreads. X-ray images, recorded on photographic film, are commonly used to screen for small tumours.

A team of researchers in Toronto, led by Martin Yaffe, has developed a means of digitizing an X-ray image for storing on a computer. The image can then be displayed and enhanced on a high resolution screen for examination by experts. This new technology produces a clearer image of the breast tissues than is possible with conventional X-ray film. It thus improves the likelihood of accurately identifying tumours, and hence correctly determining treatments.

Digitized images may be transmitted electronically thus allowing experts anywhere to examine images sent from remote locations. This will reduce disparities in the level of specialized care across Canada. The technology should prove to be cost-efficient by reducing the need for X-ray film and processing, simplifying the filing and retrieving of images and decreasing the need for storage space.

Digital mammography was first developed by Dr. Yaffe and his team in the early 1990's. Now seven major US academic centres and large corporations such as Kodak and General Electric are involved in clinical trials and development of the imaging system. Dr. Yaffe's Canadian group remains the central node of this international research effort.

Research on HIV/AIDS

Statistical overview of support delivered through MRC in 1998-99

Resources delivered	millions of dollars	6.1
Applications reviewed	Projects	57
	Groups	2
	Personnel awards	33
New HIV/AIDS research approved	Projects	21
	Groups	2
	Personnel awards	28
Total activity, including ongoing studies	Projects	43
	Groups	3
	Personnel awards	39
New knowledge generated	Articles published*	509
Lead researchers in action*		82
Future researchers in training*		186
Person years of knowledge intensive employment created*		366

* estimates based on various MRC studies

Canadians' past investments in AIDS/HIV research have had impact world wide

Canadian researchers identified a high-risk population in Africa that is resistant to HIV, thus offering a unique opportunity for the study of the mechanisms of HIV rejection. And it was Canadians who discovered the anti-HIV activity of the drug known familiarly as 3TC that has been used widely in the treatment of people infected with the virus.

A sample of ongoing research on HIV/AIDS

Researchers at Laval University are examining factors which influence use of condoms and HIV tests by singles. With the knowledge so gained, the researchers will design and produce an educational video to positively influence safe sex behaviours.

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.

At the McGill AIDS Centre a group of researchers is studying the mechanisms regulating HIV gene expression, latency and persistence. Understanding of these basic processes may lead to ideas for immobilizing the virus. The group is also examining the emergence of drug resistant variants of HIV-1.

Maintaining the efficiency and effectiveness of our health care system, always a priority, will become an increasingly important challenge as our population ages. The Council has been steadily enlarging its support for research in the delivery of health services. In 1998-99, MRC continued to provide special support for research on health care through a partnership with Health Canada and the Canadian Foundation for Health Services Research. Such research frequently leads to reductions in the cost of health care by identifying unnecessary practices and procedures. For example, a researcher at the University of British Columbia, using the results of studies on the effectiveness of screening for infant retinopathy, has recently developed clinical practice guidelines that, when implemented, would free up an estimated $3 million in provincial health care funding each year. Similarly, work by a team led by a researcher in Ottawa has found redundancy in blood transfusions administered in hospital emergency wards. By helping health professionals clearly identify the circumstances in which transfusions will be effective, and producing guidelines on the optimum amount of transfused blood, health care research will ensure more efficient use of this precious resource.

Developing capacity in research areas of particular concern to Canadians

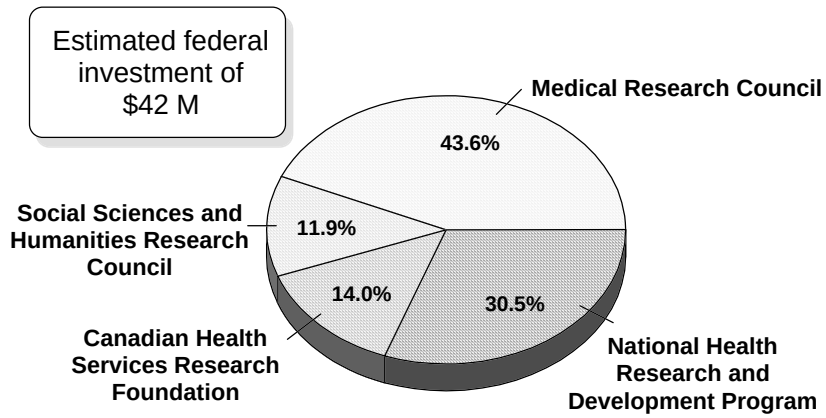
Between 1996 and 1998, there was a welcome 141% increase in the number of applications for MRC training awards for research in health services, population health, psychosocial health issues and related areas.

MRC responded to this interest in critical research areas by approving 39% of the applications, thus supporting the development of another 103 potential researchers

The approval rate for applications for MRC training awards overall during this period was 27%.

A 1998 survey of Canadians by Ekos Research Associates revealed that 82% attached a high priority to research into the prevention of disease. Since 1993, MRC has been expanding its support for such research, helping to build national capacity to generate new knowledge about the health of populations, the determinants of health and the promoting of healthy behaviours.

Federal funding for university research on social/psychological health issues, delivery of health services and the health of populations



Estimates developed by MRC, August 1999

3) Improving Health through Research

Occasionally the impact of research on health is direct and immediate: new knowledge is produced and that knowledge leads to an innovative approach to health maintenance or care, illness prevention or treatment. However, for most research projects, the impacts on health will be indirect. The research will generate new knowledge which points to critical questions that need to be answered, thereby moving us forward towards future health innovation. Research also provides a training ground for the next generation of health scientists and thus renews and sustains a national research capacity. Very importantly, conducting our own research ensures that we have a window open to new ideas emerging from studies around the world: it gives us a capacity to absorb and use research findings generated elsewhere.

Research benefits health indirectly when our researchers teach classes of medical students, or nurses or students of other health professions, inspiring them to view knowledge as the product of individual curiousity and investigation rather than as static information from textbooks. Clear thinking, critical health professionals deliver good health care. Also, since an active research environments attracts the best, most innovative health care specialists, research helps ensure that a city, or region or country can recruit high quality clinical expertise.

To illustrate the many impacts on health from a research program, we will report the work of Canadian researcher and orthopaedist, Robert B. Salter, whose ideas and research results have changed thinking about the effective healing of damaged joints. Dr. Salter's honours and awards include Companion of the Order of Canada and laureate of the Canadian Medical Hall of Fame. He has seen more than 150,000 patients, treated children from 36 different countries and completed over 2,500 X-ray consultations by mail. When asked how he managed to find time to write medical textbooks, teach, lecture around the world, provide clinical care and continue to conduct basic research he is reputed to have said "by getting up at 4 in the morning", which surprised a colleague who had assumed that he never went to bed at all!

Improving Health through Research

Profile: Research on the healing power of continuous passive motion

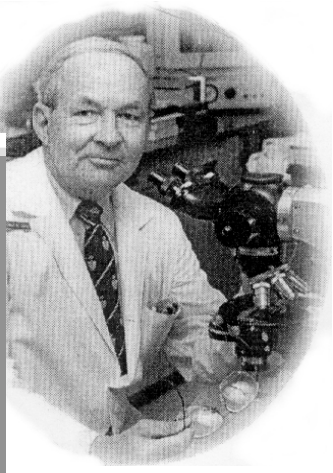
Since the time of Hippocrates, immobilization and rest have been the recommended treatment for diseased or damaged joints. It was believed that injured joint cartilage had very limited capacity to regenerate so the recovering joint should not be stressed.

Dr. Robert Salter at the University of Toronto knew from his own research that immobilization of a joint can actually damage the cartilage. He reasoned that joints need to be kept moving as they heal, and in 1970 introduced the concept of "continuous passive motion" to the world. With funding provided by the Medical Research Council over several decades, Dr. Salter discovered that the effect of continuous passive motion on healing and regeneration of cartilage in rabbits was better than that of immobilization. He collaborated with a university engineer, John Saringer, in the design of mechanical devices to slowly and gently keep patients' joints moving as they healed.

Continuous passive motion was found to be painless. It stimulates healing and regeneration of cartilage, tendons and ligaments. It prevents stiffening of joints and enhances the healing of wounds. Clinical trials of continuous passive motion confirmed the expected benefits, including shorter periods of hospitalization and rehabilitation. In contrast, immobilization of joints can produce irreparable damage that leads to osteoarthritis.

Case Profile: Impact of Research on Health

The Healing Effects of Continuous Passive Motion



Outcomes

Improved Health
Continuous Passive Motion (CPM) stimulates healing and regeneration of joint tissue.
As of 1998, CPM has helped over 5,000,000 people world-wide and offers potential for helping millions more.

Efficient Health Care
shorter hospital stays, less physiotherapy

Health Maintenance
reduced chance of subsequent joint disease

Better Treatment
new, effective approach to healing joints

New Business
manufacture of CPM equipment for 17,000 hospitals in 57 countries

Employment
70 jobs in Canada
and
1,000 in other countries

Outputs

New Knowledge Uncovered
CPM promotes regeneration of joint tissues. Results appear in 41 articles, 8 book chapters a monograph and the media

Activities

Research Conducted
Exploring the concept of continous passive motion that he originated in 1970, Dr. Robert Salter and his team conduct 24 separate projects to examine its effect on the healing of joints

Training
22 individuals learn about conducting health research

Education
Dr. Salter teaches and writes a book on CPM for scientists and clinicians

Inputs

Research Funding
over 20 years of support from Canadians through MRC

People and Ideas
education, training and experience of Dr. Salter and colleagues

Research Infrastructure
research time and facilities provided by U of T and the Hospital for Sick Children

World Knowledge Base
results of continuing advancement of knowledge of natural processes

Cross Canada Sweep:

Research with an Impact on Health

University of Manitoba

Preventing complications of diabetes…

a cardiovascular research team has found that drugs known as calcium antagonists can prevent heart dysfunction in diabetics.

University of Calgary

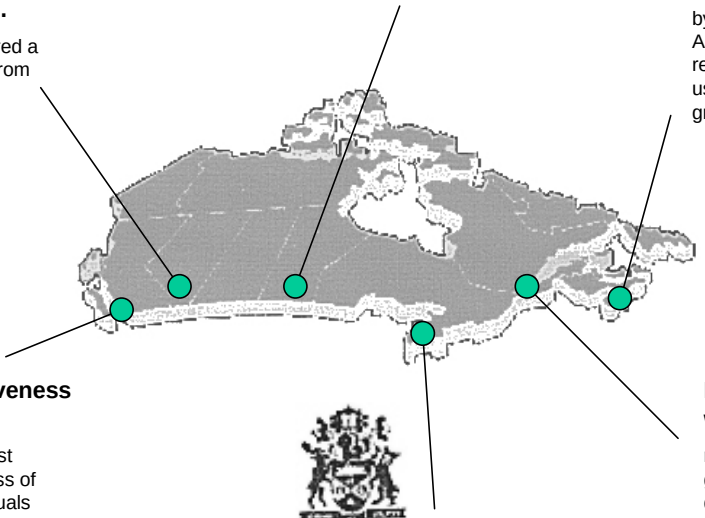
A more powerful but gentler pain reliever…

health researchers discovered a powerful pain reliever free from the harmful side effects of common aspirin.

Dalhousie University

Understanding Alzheimer's...

by identifying the links between Alzheimer's and vascular dementia, researchers are providing information useful for improving treatment of this growing health problem.



University of British Columbia

Improving the effectiveness of cancer therapy...

researchers developed a test determining the effectiveness of radiation therapy for individuals suffering from cancer. Therapy can thus be better tailored to then needs of patients.

McGill

Predicting and intervening with juvenile diabetes...

research on the role of the insulin gene in the genetics of juvenile diabetes has led to the design of a DNA test to predict this type of diabetes and new strategies to prevent its development.

University of Western Ontario

Reducing risks in brain surgery…

research has led to new techniques and procedures for the safe repair of life-threatening aneurysms in blood vessels deep in the brain.

Research is increasing the yield from health care dollars

Researchers at the Hôpital Maisonneuve-Rosemont in Montreal have developed a non-invasive test for the presence of the bacteria which causes peptic ulcers. It is safer and faster, yet much less expensive, 55 cents compared with $8.00 for conventional tests.

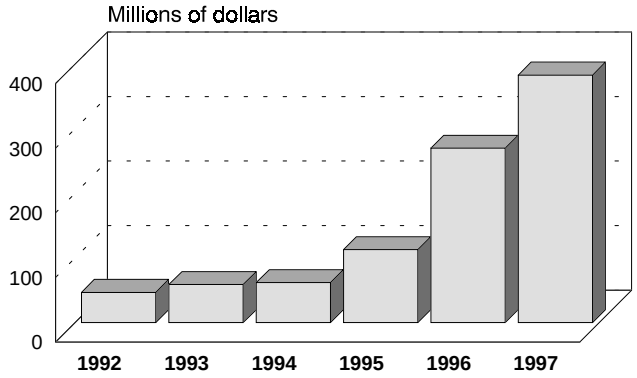
Research has increased the odds for burn victims

Twenty years ago, chances of survival were slim for someone with burns to 50% of their body. Researchers at Laval University have helped develop ways to culture replacement skin using a patient`s own cells. It is now possible to produce enough replacement skin to save someone who has burns to 95% their body.

4) Capturing the Economic Benefits of Health Research Discoveries

Occasionally a Canadian health research discovery will, in addition to having an impact on health, have significant commercial potential. Realizing this potential requires venture capital for product research and development. If the capital is not available here, commercialization will likely take place elsewhere; Canada will lose the resultant jobs, exports and wealth creation. While growth in the supply of Canadian capital for exploiting our health research discoveries cannot be attributed to MRC, the Council was instrumental in the creation of the Canadian Medical Discoveries Fund which has become the largest provider of life science venture capital in Canada.

Canadian Venture Capital Investments in Life Sciences



Source: Mary MacDonald and Associates

Another way to bring the economic benefits of health research discoveries to Canadians is to foster close linkages between the generators of new knowledge and ideas, our academic health scientists, and Canadian companies that can enable the transition from idea to marketable product. In 1998-99, the MRC invested more than $7.2 million in University-Industry grants and personnel awards to support university research conducted in partnership with industry. Registration of patents in the health area may be viewed as an indirect indicator of the success of strategic alliances between university researchers and industry R&D managers fostered by mechanisms such as the University-Industry program. In 1980, just before MRC's University-Industry program was launched, Canadians registered 50 health patents; in 1996, there were over 235 patent registrations.

Commercialization of research discoveries may be accomplished through partnerships with established corporations or through spin-off companies, that is, businesses created by universities or researchers specifically to commercialize inventions and technologies developed at a university. A recent study[1] of 83 spin-off companies in the health area found that those created since 1979 employ over 2,000 people and in 1997-98 sold $60 million worth of products, 75% to customers outside of Canada.

Building the foundation for research with commercial benefit

Nearly 60% of the founders of spin-off companies in the health area indicated that the principal source of funding for their career development had been the federal government.

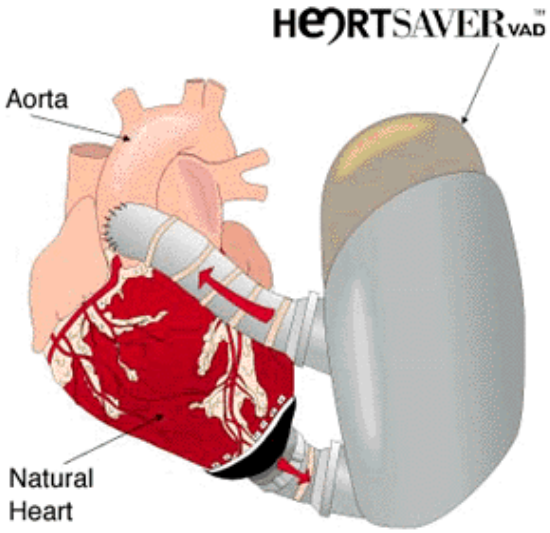
[1]. Honsberger L. Biomedical and Medical Spin-off Companies. Draft Thesis. July 1999.

Capturing the Benefits of Health Research

Case Profile: WorldHeart Corporation

The development of devices to assist the human heart requires a wide and deep understanding of 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 an implant. Conducting basic research in these areas with support from the Medical Research Council, the Heart and Stroke Foundation of Canada and others helped Dr. Wilbert Keon and colleagues 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. Keon and Dr. Tony Mussivand began the development of a fully implantable device capable of assisting either the left or right ventricle of the heart by duplicating their pumping action. Essentially an artificial heart, the device opens up the possibility of longer, active lives for people who currently have no alternative treatment available. It is estimated that each year over 150,000 people world wide could benefit from such a device. The current option, a heart transplant, is quite restricted. Shortage of available organs and other constraints limits the number of heart transplants around the world to less than 4,000 annually.



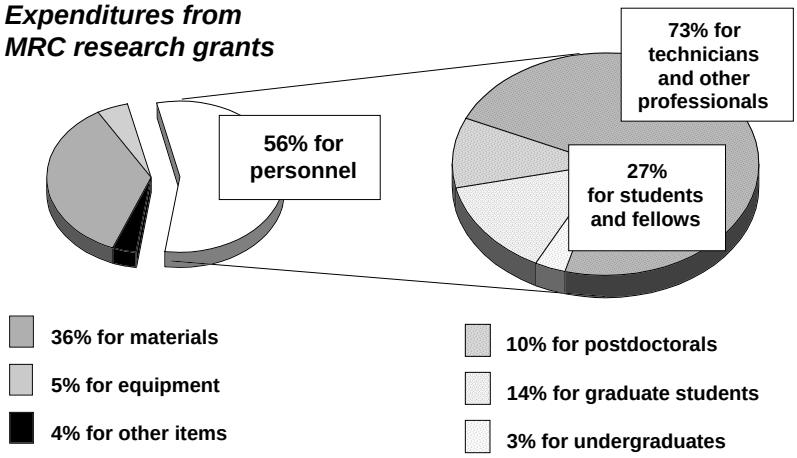
The device is remotely powered and monitored. Control is by a system that transfers data through intact skin and tissue using infrared and radio signals. With its small size, anatomical compatibility, site of implantation, transfer of power without perforation, remote communication and patient mobility, the device overcomes most of the obstacles which have hindered widespread use of ventricular assist devices so far.

In 1996, WorldHeart Corporation acquired worldwide rights to the device and related technologies developed by the team at the Ottawa Heart Institute. Based in Ottawa, WorldHeart currently has over 70 employees and is traded on both the Toronto Stock Exchange and NASDAQ. The commercial potential of the ventricular assist device, a leading product in a global market, is significant.

5) Our Most Critical Resource: Canadian Health Scientists

Health research means bright, committed, well-trained people dedicating their talents and abilities to the pursuit of new knowledge. People with ideas. Of course, researchers need accommodation, equipment, materials and supplies, but without people, everything else - the research laboratory or office, the magnetic resonance spectrometer or computer, the boxes of chemical reagents or health behaviour survey forms - stands idle. About 56% of the typical MRC grant goes towards supporting people: graduate students, research technicians and postdoctoral fellows who assist researchers with their work.

Research Provides Training and Employment



In addition to supporting an estimated 2,730 students and 370 postdoctoral fellows through research grants, MRC supports a further 800 students and 450 fellows through its research training awards programs. Awards provide personal support and research allowances to persons who exhibit exceptional potential to pursue careers as independent researchers. The Council has conducted studies of the subsequent careers of students and fellows whose training had been supported through personal awards. Findings revealed high rates of completion of study programs and showed that large percentages of former award holders went on to careers in research, many of them both brilliant scientifically and themselves influential on the development of future scientists.

The Council also offers programs to provide salaries for some of Canada's very best health scientists, to enable them to work full-time at research. Programs are targeted at all stages of career development, from the recently-trained researcher, setting up her or his first independent research project, to the distinguished scientist who should be recognized both as a superb research

On instilling in young people an admiration for the great game called health research

We Canadians still have a long way to go in communicating to young people the excitement of health research and a recognition of its star players.

A young patient at the Hospital for Sick Children in Toronto, on hearing that his doctor, Robert Salter, was being inducted into a Hall of Fame, asked for his autograph. But when the child learned that it was for medical discoveries, not for playing hockey, that Dr. Salter was being honoured, the request for a signature was promptly withdrawn!

contributor and as a role model for young Canadians. In 1997-98, MRC invested over $22 million in career awards for more than 430 of Canada's most outstanding health researchers.

Training and Developing Canadian Health Scientists

Profile: Christina Addison, PhD

Representative of the thousands of Canadians receiving training in research in the health sciences, Christina Addison has completed a PhD and is now pursuing postdoctoral studies in the United States to broaden her research experience before returning to Canada to launch a career as an independent researcher. She writes:

> *"The funding support enabled me to work on a thesis project that led to investigation of a new medical treatment in the clinic."*

Her doctoral work was in the laboratory of Dr. Frank Graham at McMaster University in Hamilton. On the leading edge of cancer research, its goal was to make cancer cells more visible to the immune system so that they may be destroyed by the body`s natural defences. In the research project, viral vectors were used to carry genes into tumour cells. There the genes produced a transformation of the cancer cells such that the immune system could recognize them as foreign to the body and targets for elimination. Christina's work led to a preliminary human trial of the intervention. Early results indicate effectiveness with some melanomas and breast cancers.

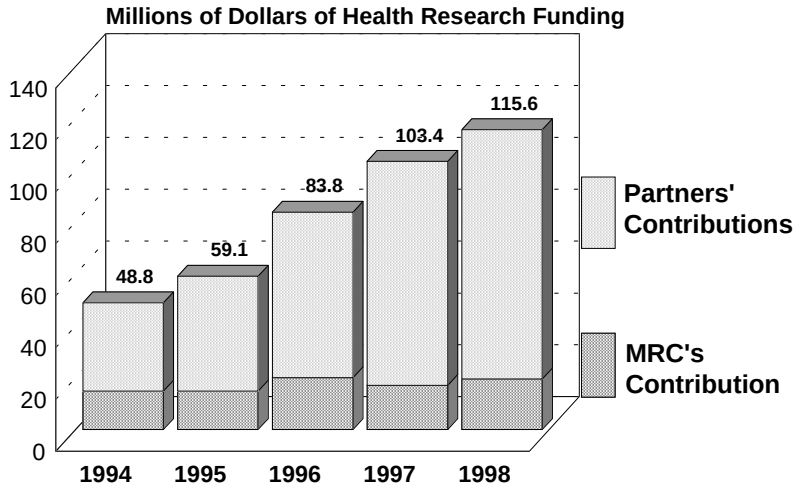
> *"A graduate student award helps financially, but the prestige and recognition that goes along with being the recipient of an award is by far the most important thing. Having an MRC or NCIC award on your CV opens up a lot of doors for your career.*"

The MRC continues to refine its criteria and procedures for selecting recipients of personnel awards to ensure that they are fair, logical and flexible. A recent study of the MRC's system for selecting recipients of doctoral research awards (a system in which selection criteria were chosen for their relevance to research careers, weighted according to predictive strength, and carefully defined and scaled for use by reviewers) indicated highly satisfactory performance in terms of freedom from bias and ease of use by reviewers. Over the long-term, the system will provide an outstanding database for further study of research career predictors.

6) Expanding Canadian Health Research Capacity Through Partnerships

Partnerships between MRC and other funders of health research have three major benefits for Canadians. First, partnerships bring more resources to bear in a given research area. They concentrate funding on specific issues, often permitting the development of a critical mass of researchers which enables results that would never have been achieved if the partners had gone it alone. Partnerships can increase the overall impact of the public investment in research through MRC. Second, partnerships help bring funders, researchers, health professionals and interested Canadians together over a common issue, be it the improvement of life for diabetics or the assurance of Canadian capacity in human genetics. Different perspectives on health issues often generate ideas for new research approaches. Third, partnerships can increase the total Canadian health science effort. This occurs when MRC's partner would not have funded the research unless in concert with MRC, or when the partner would have supported the research, but at a greatly reduced level.

Growth in Research Funding Delivered Jointly with Partners

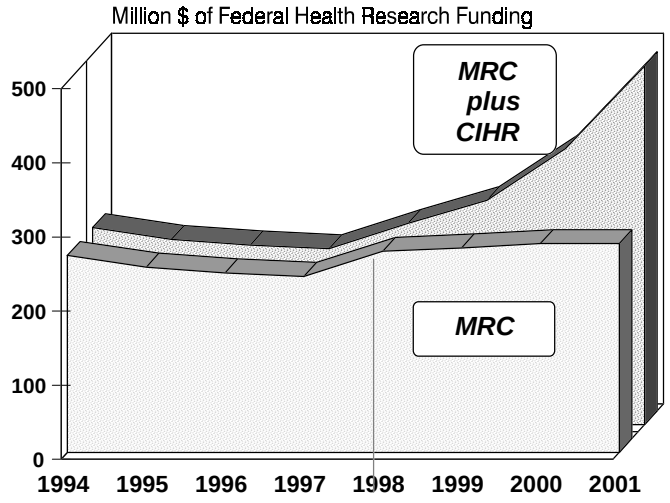


The Council has been investing a significant portion of its budget in partnered programs of research grants and personnel awards. In 1998-99, MRC delivered $19.4 million, 9.0% of its funding, through shared initiatives. Partners have been generous with their contributions. In 1998-99 they invested $96.2 million, that is, $4.90 for every $1.00 from MRC.

Council is proud of its partners in health science research funding and greatly values the varied perspectives they bring to joint initiatives. Representing more than 130 organizations, MRC's partners include Canadian and international health charities, provincial health organizations, companies with specialties ranging from pharmaceutics to medical devices to biotechnology, professional organizations and federal departments and agencies.

Building on a broad base of successful joint ventures in health research programming, in April 1998 MRC began assembling an unprecedented coalition of university leaders, health researchers, heads of health charities, federal departments and research agencies, provincial health organizations and industry representatives to jointly plan a national framework for Canadian health research. By October, the coalition was ready to present to the Minister of Health its vision of a well-resourced health science enterprise organized around 10 to 15 health research themes. Their proposal for the creation of Canadian Institutes of Health Research was enthusiastically received and in February 1999, in its budget announcements, the federal government began making the vision a reality. Government plans to invest more than $500 million in additional funding for Canadian health research by the year 2001-02, more than doubling last year's level of federal funding for university research. These resources, delivered through CIHR, the most encompassing health research partnership that Canada has ever seen, will allow a broadening, deepening, focussing and quickening of the pace of our health research activity. The benefits to the health of Canadians will be outstanding.

The New Landscape for Canadian Health Research



CIHR: Canadian Institutes of Health Research

Profile of a Research Funding Partnership

The Canadian Neurotrauma Research Program

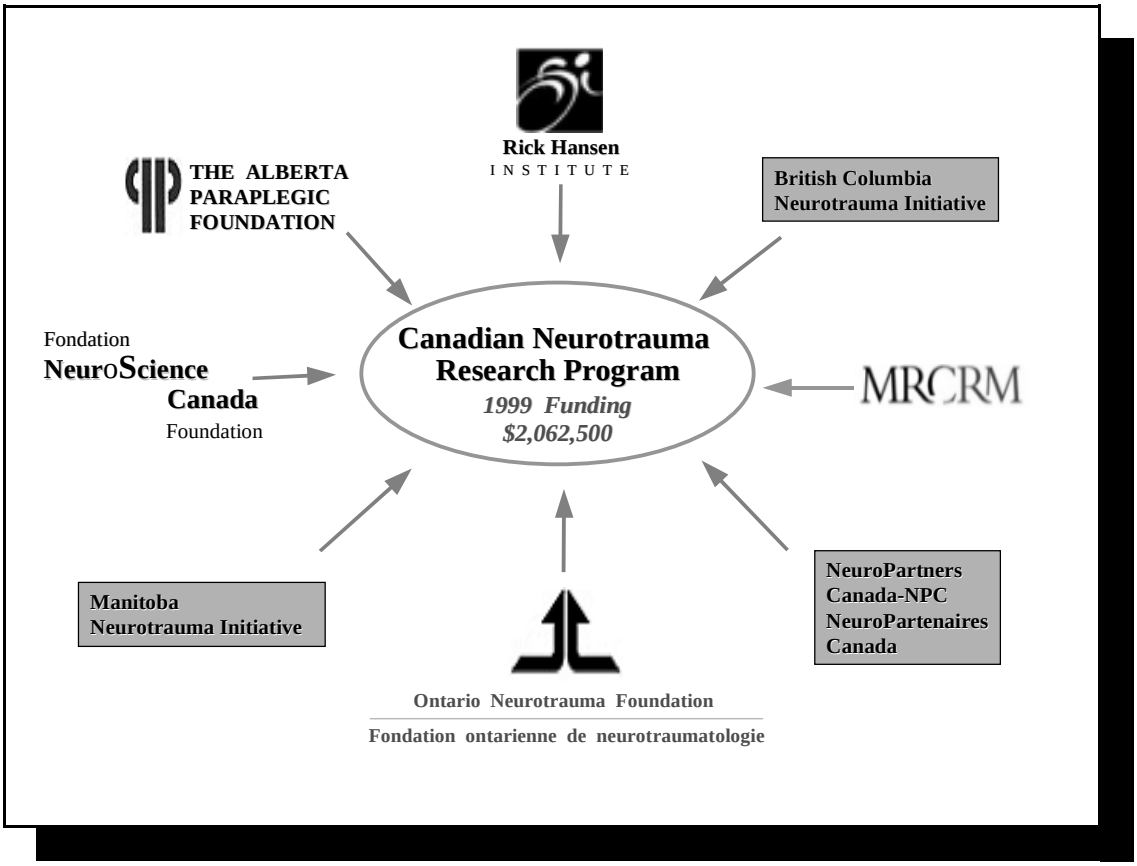
The challenge addressed by the research funding partners:
Each year more than 41,000 Canadians suffer spinal and brain cord injuries, usually caused by motor vehicle accidents or falls. The pain and loss of function for victims, and the anguish caused their loved ones, is immeasurable. Treatment and care of new neurotrauma patients has been estimated to cost over $900 million annually.

The research question posed by the funding partners:
The ultimate goal of research on neurotrauma is to find ways and means of restoring physical and mental functions to victims. Canadian researchers are at the forefront in the global search for answers to questions about the growth and regeneration of nervous tissue.

The funding partnership:
The Canadian Neurotrauma Research Partnership brings together eight organizations to focus resources on neurotrauma research in a determined and coordinated effort to help Canadian scientists accelerate the course of discovery. The Partnership will offer grants for neurotrauma research projects by established scientists and will award postdoctoral research fellowships to encourage scientists to specialize in the area.

"You can't put a price on the impact of a brain or spinal cord injury on a young person's life. Neurotrauma is a life-shattering event... Research holds the key to a cure and to enabling people with neurotrauma injuries to participate fully in society."

Rick Hansen



MRC Partnerships for Canadian Health Science

	Estimated Financial Contributions of Partners ($thousands)		
	1997-98	**1998-99**	cumulative *1994 to 1999*
***Industry Partners** (80)*			
MRC-PMAC Health Program	50,914	**46,071**	155,554
University-Industry Program	3,068	**3,686**	25,673
***Voluntary Health Organizations** (15)*			
Juvenile Diabetes Fund International	1,000	**1,000**	3,000
Burroughs Wellcome Fund	709	**719**	2,091
Other voluntary health organizations	924	**2,700**	4,106
Other Partners (25)			
Canadian Health Services Research Fund	11,000	**11,000**	33,000
Networks of Centres of Excellence		**11,455**	11,455
AIDS Strategy Research	5,500	**5,440**	29,418
Canadian Breast Cancer Research Initiative	6,136	**9,268**	31,186
Genome Analysis and Technology	3,001	**371**	5,127
Other	3,103	**4,498**	19,223
Total Contribution of Partners	85,355	**96,208**	390,956
MRC Contributions	16,990	**19,354**	85,689
Ratio of MRC Funding to Partners' Funding	1 to 4.8	**1 to 4.9**	1 to 3.7
Percent of MRC Budget Invested in Partnerships	7.9	**9.0**	7.6

Note 1: Partnerships can take many possible configurations. Data may reflect: amounts that a) were expended through the partnership, b) have been contributed to the partnership or c) have been contributed to the partnership but not yet fully invested through research grants or awards. **Note 2**: Partners' contributions in prior years have been adjusted to reflect definitions of partnerships and contributions used for 1998-99 data. **Note 3**: Through a reduction in its budget, MRC made a $2.2M contribution to the NCE program in 1998-99, thus commencing partnered funding of the program.

7) A National Perspective on Health Research Issues

Promoting High Ethical Standards

We Canadians expect not only that our health research be world-class and beneficial but that it also respect high ethical standards. The MRC is pleased to report progress on implementing the policy on ethical conduct for research involving humans that was issued jointly by MRC and the other two federal research granting councils last year.

Since the 1970's, universities and research institutions across Canada have established local committees to judge the ethical acceptability of research work conducted within their facilities. The committees, known as Research Ethics Boards, form a national network of Canadians who have thought deeply and critically about ethical issues. A good measure of their performance is the rarity with which stories of suspect research appear in the media. Proposals for unethical research are rejected by local research ethics boards as unacceptable.

Tri-Council Policy Statement

Ethical Conduct for Research Involving Humans

The people of Canada. . . have created and funded the MRC, NSERC and SSHRC... The Councils wish to promote research that is conducted according to the highest ethical standards... As a condition of funding, we require that researchers and their institutions apply the ethical principles and articles of this policy.

Guiding Ethical Principles

Respect for Human Dignity
Respect for Free and Informed Consent
Respect for Vulnerable Persons
Respect for Privacy and Confidentiality
Respect for Justice and Inclusiveness
Balancing Harms and Benefits
Minimizing Harms
Maximizing Benefit

Implementation of the tri-Council guidelines has focussed initially on informing researchers and members of research ethics boards about them through a series of cross-country meetings and workshops. These discussions are helping to increase uniformity of interpretation of the guidelines, an issue of particular importance for large clinical trials where researchers from many different health centres participate. A working group has been formed to bring university and industry people together to develop templates for reviewing the ethics of research at all stages of development of new health products.

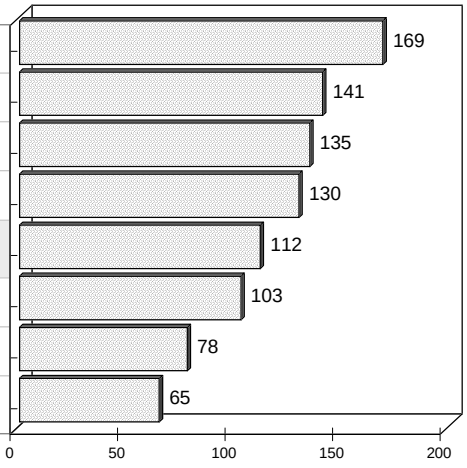
Promoting International Collaboration

Health science is an international activity and rare is the Canadian health scientist who is not in some way closely connected with researchers in other countries. One role of MRC is to expand and fortify these natural collaborations through special programs and projects developed with funding agencies in other countries. In 1998-99, the Council helped facilitate a series of scientific orientations with Japanese counterparts to identify specific areas in which joint research efforts would be exceptionally productive. Work also continued on the development of Foundations to support ongoing exchanges between Canada and both Israel and Palestine.

International Collaboration is Increasing

Publications resulting from collaborations between Canadian health researchers and researchers in other countries

in 1990	in 1996		percent increase
106	285	Germany	169
51	123	Australia	141
68	160	Netherlands	135
94	216	Japan	130
399	844	All Other	112
233	473	United Kingdom	103
238	424	France	78
1702	2809	United States	65



Source: L'Observatoire

IV CONSOLIDATED REPORTING

Year 2000 (Y2K) Readiness

Prepared for Year 2000

The MRC expects all mission critical computer systems within its control to function effectively as we enter the next millennium. The Council has recently implemented a re-engineered information technology system with integral Y2K compliance. That system covers the main MRC financial and operational transactions. The resolution of issues in the remaining MRC systems is on track as of the time of writing (September 1999). Contingency plans have been developed for critical areas such as continued flow of funds to MRC award holders.

Other Consolidated Reporting Issues

The MRC is not required to report upon:

- Material Management
- Sustainable Development
- Fuel Storage Tanks
- Regulatory Initiatives

Annual Report of the MRC

The Council will submit a separate Annual Report, the *MRC Report of the President*, to Parliament for 1998-99.

V FINANCIAL PERFORMANCE

Financial Performance Overview

The Medical Research Council of Canada has for 30 years consistently provided prudent, effective and efficient management of its appropriations from Parliament. Deployment of a wide variety of grants and scholarships mechanisms, each designed to contribute to the overall impact of the federal research investment, has ensured continuing achievement of program objectives. Expenditures on the administrative operations that support program delivery have been kept relatively low, thanks in part to the many Canadian scientists who freely offer their time and expertise to assist the Council in its review of proposals.

Efficiency in research . . .

Canadian scientists produce more publications per unit of R&D funding than do those in Australia, the United States, France, Italy, Germany or Japan.

Efficient use of funds by Canadian researchers is indicated by international comparisons of the number of scientific publications produced relative to funding available for research and development (R&D). An analysis reported in the journal *Science* in July 1998 reveals that Canadian scientists produce more publications per unit of R&D funding than do those in Australia, the United States, France, Italy, Germany or Japan.[2]

. . . and in research program delivery

When the funding contribution of partners is taken into the calculation, the $12.2 million expenditure on MRC administration accounts for only 3.3% of the total investment in research

In 1998-99, expenditures on administration of the MRC program ($12.2 million after including contributions to employee benefit programs) account for only 4.5% of the total MRC appropriation. Further, MRC provides extensive administrative support for the many research programs that it funds in partnerships with others. When the $96.2 million provided by funding partners in 1998-99 is taken into the calculation, the $12.2 million expenditure on MRC administration accounts for only 3.3% of the total investment in research.

[2] May, RM. (1998). The Scientific Investments of Nations. *Science.* Volume 281, pages 49-51

While readers should find that most items in the following tables are readily understood, an explanation of the authorized increase to planned operating expenditures may be helpful. The $2.7 million increase to planned operating expenditures in 1998-99 enabled completion and implementation of a new integrated electronic information system that provided both modernization and Y2K compliance. The authorized increase also facilitated the coordination of a multi-stakeholder initiative to develop a national framework for Canadian health science. That initiative led to government's announcement in February 1999 of plans for the Canadian Institutes of Health Research.

List of Financial Tables

n/a: not applicable to the MRC

Financial Table 1

Summary of Voted Appropriations

Vote		1998-99 Spending		
		Millions of dollars		
		Planned Spending	**Total Authorities**	**Actual**
	Medical Research Council			
15	Operating expenditures	8.7	*11.4*	**11.3**
25	Grants and Scholarships	257.7	*259.2*	**259.2**
(S)	Contribution to employee benefit plans	0.9	*0.9*	**0.9**
	Totals	267.3	*271.5*	**271.4**

Note: Figures in the table may not appear to add correctly because of rounding.

Financial Table 2

Comparison of Planned and Actual Spending, 1998-99

Medical Research Council of Canada

		Planned	*Total Authorities*	**Actual**
Full-time Equivalents	*number*	83	*85*	**85**
Millions of dollars				
Operating		9.6	*12.3*	**12.2**
(includes contributions to employee benefit plans)				
Capital		-	-	**-**
Voted Grants and Contributions		257.7	*259.2*	**259.2**
Subtotal (Gross Voted Expenditures)		267.3	*271.5*	**271.4**
Statutory Grants and Contributions		-	-	**-**
Total Gross Expenditures		267.3	*271.5*	**271.4**
Less:	Respendable Revenues[2]	-	-	**-**
Total Net Expenditures		267.3	*271.5*	**271.4**
Less:	Non-Respendable Revenues[3]	-0.5	*-0.5*	**-0.7**
Plus:	Cost of Services Provided by other Departments	0.7	*0.7*	**0.7**
Net Cost of the Program		267.5	*271.7*	**271.4**

Note: Figures in the table may not appear to add correctly because of rounding.

2 These revenues were formerly called “Revenues Credited to the Vote”.

3 These revenues were formerly called “Revenues Credited to the (CRF)”.

Financial Table 3

Historical Comparison of Total Planned Spending to Actual Spending

Medical Research Council of Canada

millions of dollars

1996-97	**1997-98**	**1998-99**		
Actual	**Actual**	Planned	*Authorized*	**Actual**
251.2	**237.3**	267.3	*271.5*	**271.4**

Tables 4, 5 and 6 do not apply to the MRC

Financial Table 7

Non-Respendable Revenues[4]

Medical Research Council of Canada

millions of dollars

1996-97	**1997-98**	**1998-99**		
Actual	**Actual**	Planned Spending	*Total Authorities*	**Actual**
0.4	**0.9**	0.5	*0.5*	0.7

Table 8 does not apply to the MRC

4 These revenues were formerly called “Revenues Credited to the (CRF)”.

Financial Table 9

Transfer Payments

Medical Research Council of Canada

Grants and Scholarships

millions of dollars

1996-97	**1997-98**	**1998-99**		
Actual	**Actual**	Planned Spending	*Total Authorities*	**Actual**
233.8	**228.1**	257.7	*259.2*	**259.2**

VI OTHER INFORMATION

MRC Contact List

Role	Name	Telephone (area 613)	e-mail	Fax (area 613)
President	Henry G Friesen, MD	954-1809	hfriesen@mrc.gc.ca	954-1802
Executive Director	Karen Mosher	954-1813	kmosher@mrc.gc.ca	954-1802
Directors *alphabetic listing by branch*				
Business Development	Marc LePage	941-2725	mlepage@mrc.gc.ca	941-1040
Corporate Services	Guy D'Aloisio	954-1946	gdaloisi@mrc.gc.ca	954-1800
Communications	Marcel Chartrand	954-1812	mchartrand@mrc.gc.ca	954-6653
Ethics and International Relations	Francis Rolleston, D. Phil.	954-1801	frollest@mrc.gc.ca	954-6653
MRC-PMAC Health Program	Robert Dugal, PhD	941-6706	rdugal@pmac-acim.org	946-0885
Programs	Mark Bisby, PhD	954-1959	mbisby@mrc.gc.ca	952-2277

Web Site

Legislation

The Council was created by an Act of Parliament through the Medical Research Council Act (R.S., C. M-9).

Agency Reports

The Council is required to submit to Parliament an Annual Report of the President.

A full list of MRC publications is available from the MRC Communications Branch.

Additional Information

Distribution of MRC Expenditures by Province, 1998-99

Province	$ (000)	Percent
British Columbia	22,618	7.4%
Alberta	31,741	12.0%
Saskatchewan	2,618	1.1%
Manitoba	8,156	3.3%
Ontario	95,782	39.0%
Quebec	76,525	31.2%
New Brunswick	58	0.0%
Prince Edward Island	109	0.0%
Nova Scotia	6,028	2.5%
Newfoundland	1,688	0.7%
Other	9,247	3.8%
Outside Canada	4,617	1.9%
Total	259,187	100.0%

Some additions may not agree due to rounding

Grants and Awards by Type, 1998-99

Category of Support	Type of Grant or Award	Number	Amount
			$ thousands
GRANTS	Operating	2,180	153,909
	Maintenance	60	3,325
	Equipment	18	2,321
	Health Services Research Fund	1	2,000
	Regional Partnerships	33	854
	Breast Cancer Research Initiative	1	2,000
	Special Projects	8	2,325
	MRC Genome	11	334
	University-Industry Grants	155	5,338
	General Research Grants	16	1,600
	subtotal	*2,483*	*174,006*
MULTI-DISCIPLINARY	MRC Groups	39	22,090
	Program Grants	5	1,810
	Development Grants	1	31
	subtotal	*45*	*23,931*
SALARY SUPPORT	MRC Groups	25	1,625
	Development Grants	45	1,628
	Distinguished Scientists/Career Investigators	27	1,456
	MRC Scientists and Senior Scientists	110	5,652
	Scholarships	189	9,021
	Clinician Scientists Phase 2	18	1,190
	Regional Partnerships		643
	U-I Salary Support Programs	84	1,019
	subtotal	*498*	*22,234*
RESEARCH TRAINING	Clinician Scientists Phase 1	28	1,008
	Fellowships including Centennial and Dental	441	10,009
	Studentships	509	9,176
	Burroughs Wellcome Student Research Fund	305	533
	Regional Partnerships		18
	Partnerships Challenge Fund		1,693
	U-I Training Awards	85	936
	subtotal	*1,368*	*23,373*
TRAVEL AND EXCHANGE	Visiting Scientists	14	150
	Symposia & Workshops	26	137
	subtotal	*40*	*287*
OTHER ACTIVITIES	President's Fund	37	524
	Grants to Other Organizations	6	1,177
	subtotal	*43*	*1,701*
	TOTAL, CORE PROGRAMS	4,477	245,532
	Networks of Centres of Excellence	6	*13,655*
	TOTAL ALL PROGRAMS	4,483	259,187

Some additions may not agree due to rounding

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